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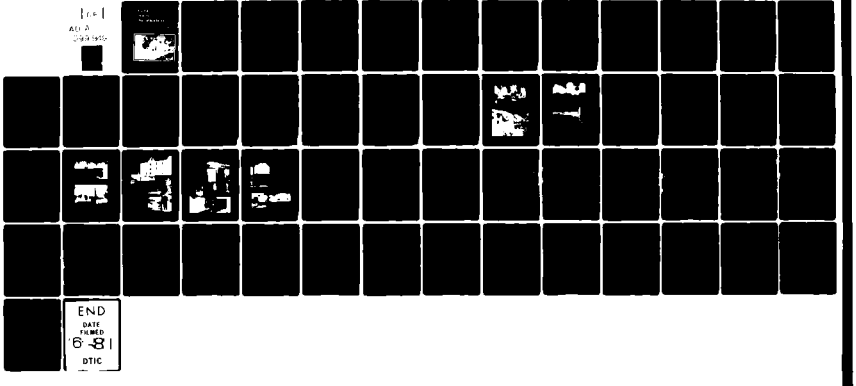

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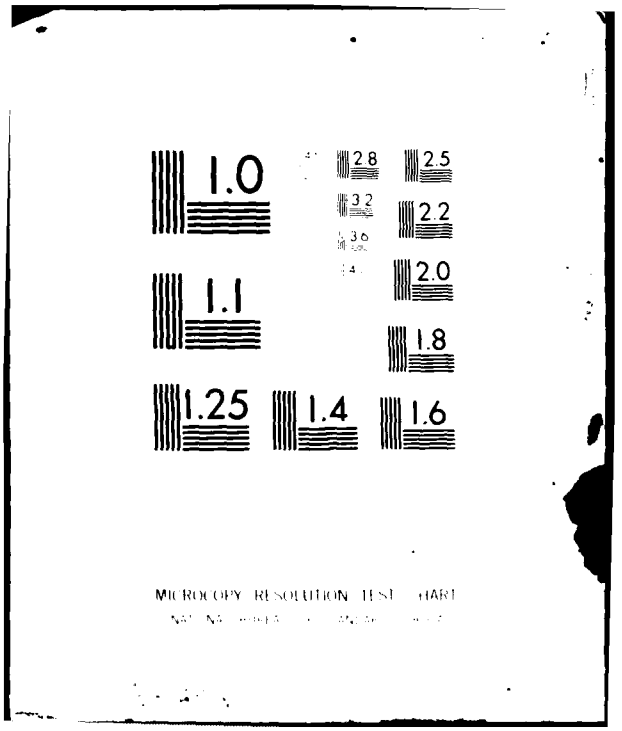
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FLOOD PLAIN INFORMATION

BRANDYWINE CREEK

CHESTER COUNTY PENNSYLVANIA

PREPARED FOR THE CHESTER COUNTY PLANNING COMMISSION BY THE DEPT. OF THE ARMY, PHILADELPHIA DISTRICT, CORPS OF ENGINEERS, PHILADELPHIA, PA.

MARCH 1972

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Chester County Planning Commission
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Flood forecasting
Flood plains

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The portion of Brandywine Creek covered by this report was part of the Main Stem with Smith's bridge approximately 500 feet downstream from the Pa-Del. border near Cossart, Pennsylvania and continuing upstream to the confluence of the East and West Branches near Lenape, Pennsylvania. This was the third of four reports covering flooding along Brandywine Creek and its tributaries.

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* U.S. GPO: 1974—540-647/9082

TO THE REQUESTOR:

This Flood Plain Information (FPI) Report was prepared by the Philadelphia District office of the U.S. Army Corps of Engineers, under the continuing authority of the 1960 Flood Control Act, as amended. The report contains valuable background information, discussion of flood characteristics and historical flood data for the study area. The report also presents through tables, profiles, maps and text, the results of engineering studies to determine the possible magnitude and extent of future floods, because knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning floodplain utilization. These projections of possible flood events and their frequency of occurrence were based on conditions in the study area at the time the report was prepared.

Since the publication of this FPI Report, other engineering studies or reports may have been published for the area. Among these are Flood Insurance Studies prepared by the Federal Insurance Administration of the Federal Emergency Management Agency, Flood Insurance Studies generally provide different types of flood hazard data (including information pertinent to setting flood insurance rates) and different types of floodplain mapping for regulatory purposes and in some cases provide updated technical data based on recent flood events or changes in the study area that may have occurred since the publication of this report.

It is strongly suggested that, where available, Flood Insurance Studies and other sources of flood hazard data be sought out for the additional, and, in some cases, updated flood plain information which they might provide. Should you have any questions concerning the preparation of, or data contained in this FPI Report, please contact:

U.S. Army Corps of Engineers
Philadelphia District
Custom House, 2nd and Chestnut Streets
Philadelphia, PA 19106

ATTN: Flood Plain Mgt. Services Branch, NAPEN-M

Telephone number: (215) 597-4807

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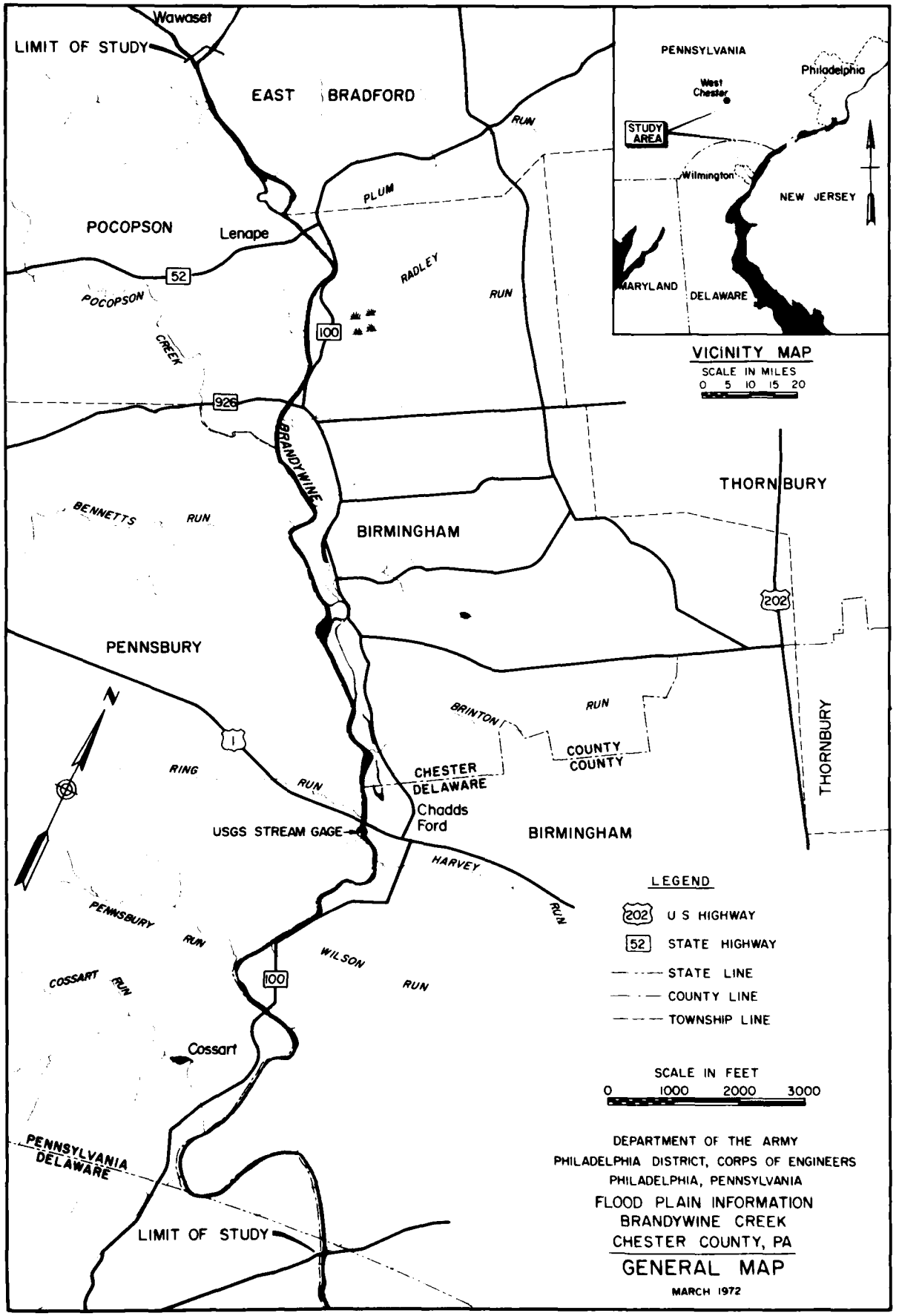
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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA
GENERAL MAP
MARCH 1972

PLATE 1

PREFACE

The portion of Brandywine Creek covered by this report is part of the Main Stem beginning with Smith's bridge approximately 500 feet downstream from the Pennsylvania-Delaware border near Cossart, Pennsylvania, and continuing upstream to the confluence of the East and West Branches near Lenape, Pennsylvania. This is the third of four reports covering flooding along Brandywine Creek and its tributaries. The developed areas of the flood plain along this reach of Brandywine Creek are primarily residential and commercial and have been damaged by past floods. Many areas in the flood plain along this stretch of the creek may become more populated and developed in the future. Although large floods have occurred in the past, studies indicate that even larger floods are possible.

This report has been prepared because a knowledge of flood potential and flood hazards is important in land use planning and for management decisions concerning flood plain utilization. It includes a history of flooding along Brandywine Creek and identifies those areas that are subject to possible future floods. Special emphasis is given to these possible future floods through maps, photographs, profiles and cross sections. The report does not provide solutions to flood problems; however, it does furnish a suitable basis for the adoption of land use controls to guide flood plain development and thereby prevent intensification of the loss problems. It will also aid in the identification of other flood damage reduction techniques such as works to modify flooding and adjustments including flood proofing which might be embodied in an overall flood plain management (FPM) program. Other FPM program studies--those of environmental attributes and the current and future land use role of the flood plain as part of its surroundings--would also profit from this information.

At the request of the Chester County Planning Commission and endorsement of the Pennsylvania Department of Environmental Resources, this report was prepared by the Philadelphia District Office of the U.S. Army Corps of Engineers under the continuing authority provided in Section 206 of the 1960 Flood Control Act, as amended.

Assistance and cooperation of the U.S. Geological Survey, Soil Conservation Service, Chester County Planning Commission, and private citizens in supplying useful data and photographs for the preparation of this report are appreciated.

Additional copies of this report can be obtained from the Chester County Planning Commission. The Philadelphia District Office, upon request, will provide technical assistance to planning agencies in the interpretation and use of the data presented as well as planning guidance and further assistance, including the development of additional technical information.

BACKGROUND INFORMATION

Settlement

The Brandywine Valley was originally the home of the Lenni-Lenape Indians who valued the fertile soil for growing crops and the abundant supply of fish and game which provided a never-ending source of food. The first white settlers in the area, however, saw the Brandywine as a potential source of power for their mills and they found iron, copper, and vast forests for making charcoal to supply their forges. As the white man industrialized the area, the Indians reluctantly abandoned it and eventually sold the Brandywine valley to William Penn in 1683.

The development of the Brandywine valley continued and it has been said that at the peak of industrial importance, there were 130 mill sites on Brandywine waters. By the time of the Revolutionary War, this industrialization was of significant military importance and the area was the site of the Battle of Brandywine in 1777. The prosperity of the Brandywine mills passed with the coming of the Erie Canal and the railroads, which introduced competition from the west. For many years, the Brandywine Valley remained undisturbed and has retained its natural beauty. However, as modern industrial activity increases in the Brandywine valley, the accompanying increase in population will result in additional settlement of the area.

The Stream and Its Valley

The Brandywine Creek, with a total drainage area of 323.8 square miles, is a major tributary of Christina River. The main branch of the Brandywine drains portions of Chester and Delaware Counties in southeastern Pennsylvania and portions of New Castle County, Delaware. The East and West Branches, the two main tributaries of Brandywine Creek, unite to form the main stream near Lenape, Pennsylvania. The Brandywine then flows 20.3 miles south to its confluence with Christina River at Wilmington, Delaware. The portion of Brandywine Creek included in this study is shown on the general map.

From the origin of the main stream near Lenape, Brandywine Creek follows a winding course through a relatively broad, flat flood plain bordered by gently to steeply sloping hills. The elevation of the stream at the junction of the East and West Branches is 170 feet above mean sea level datum. The stream slope within the 9.8 mile study area falls 36 feet or an average of 3.7 feet per mile. The flood plain generally consists of wide, flat fields covered by underbrush, with some wooded areas and a number of low-lying areas

with standing water. The creek also forms several islands within the study reach. Downstream of the study area, the flood plain becomes narrower and steeper and the creek flows swiftly over short rapids to its confluence with Christina River at Wilmington. Drainage areas contributing to runoff at locations in or near the study area are shown in Table 1.

The climate is moderate with hot, humid summers and damp, but not cold, winters. Average annual precipitation is 45 inches, with the greatest amounts of rainfall generally occurring in July and August and the least amounts, in autumn and early winter.

TABLE 1
DRAINAGE AREAS ALONG BRANDYWINE CREEK

Location	Mileage Above Mouth	Drainage Area	
		Tributary sq. mi.	Total sq. mi.
West Branch Brandywine Creek			
At Confluence with East Branch	20.3	134.6	-----
East Branch Brandywine Creek			
At Confluence with West Branch	20.3	123.3	-----
Main Stem Brandywine Creek			
At Confluence with East and West Branches	20.3	-----	257.9
Plum Run	18.9	3.6	263.6
Radley Run	17.8	4.2	268.4
Pocopson Creek	17.6	9.2	277.7
Bennetts Run	17.0	2.9	281.3
Brinton Run	15.5	1.4	285.0
Ring Run	15.1	2.1	287.4
At Chadds Ford Gage	14.8	-----	287.0 (a)
Harvey Run	14.8	3.8	291.5
Wilson Run	13.9	3.3	294.8
Cossart Run	12.2	2.0	296.8
At Pennsylvania-Delaware State Line	10.6	-----	299.9

(a) U.S.G.S. drainage area at Chadds Ford gage is 287.0 square miles.

Developments in the Flood Plain

Within the study area, the flood plain of Brandywine Creek is rural and largely undeveloped. Portions of the flood plain are devoted to farming or pasture with widely-scattered residential structures. A number of buildings are located on the flood plain a short distance downstream of the confluence of the East and West Branches, including the buildings of Lenape Park and a number of residences in the general vicinity. In the Chadds Ford area, development in the flood plain includes residential and commercial structures and the Brandywine Museum. The only major industry located in the flood plain is adjacent to Lenape Park downstream of the Pennsylvania Route 52 bridge.

Three small dams are located on Brandywine Creek. One is in Lenape Park, the second is located approximately one half mile downstream of Bennetts Run, and the third, 200 feet upstream of the U.S. Route 1 bridge at Chadds Ford. The three dams are all of the low-flow type having no significant storage capacity.

In addition to the limited residential, commercial and industrial development in the flood plain, railroads, state and local roads and utility lines would be subject to flooding. Increased industrial and commercial activity and a subsequent increase in population will probably occur in the area, intensifying development of the flood plain.

FLOOD SITUATION

Sources of Data and Records

The United States Geological Survey (U.S.G.S.) maintains gaging stations at Chadds Ford, Pennsylvania, and Wilmington, Delaware, on the main stem of Brandywine Creek. The Chadds Ford gage has continuous records of daily flows from August 1911 through December 1953 and October 1962 to date. The Wilmington gage records daily flows and has been in operation since October 1946. In the Upper Basin, a gage has been maintained on the East Branch near Downingtown, Pennsylvania, from October 1965 to date, while on the West Branch, one was maintained at Coatesville, Pennsylvania, for the period October 1943 to December 1951.

To supplement the records at the gaging stations, newspaper files, historical documents and records were searched for information concerning past floods. These records have developed a knowledge of floods which have occurred on Brandywine Creek.

Maps prepared for this report were based on U.S. Geological Survey quadrangle sheets entitled "Unionville, Pennsylvania," 1953; "West Chester," 1954; "Kennett Square, Pennsylvania-Delaware," 1954; and, "Wilmington North, Pennsylvania-Delaware," 1954. Structural data on bridges and culverts were obtained by field surveys performed by Corps of Engineers, Philadelphia District, personnel.

Flood Season and Flood Characteristics

Major flooding in this reach of Brandywine Creek has occurred during the summer and fall seasons. The only major flood to occur outside of these seasons was that of March 1920. Some flooding has occurred within the study area during all months of the year and usually results from heavy rains within the watershed. Stages can rise from normal flow to extreme flood peaks in relatively short time periods with high velocities in the main stream channel. In addition to floods caused by runoff from general rainfall, the Brandywine is susceptible to hurricane activity and floods from snowmelt in combination with rainfall.

Factors Affecting Flooding And Its Impact

Obstructions to floodflows - Natural obstructions to floodflows include trees, brush and other vegetation growing along the stream banks in floodway areas. Man-made encroachments on or over the streams such as dams, bridges and culverts can also create more extensive flooding than would otherwise occur.

During floods, trees, brush and other vegetation growing in floodways impede floodflows, thus creating backwater and increased flood heights. Trees and other debris may be washed away and carried downstream to collect on bridges and other obstructions to flow. As floodflows increase, masses of debris break loose and a wall of water and debris surges downstream until another obstruction is encountered. Debris may collect against a bridge until the load exceeds its structural capacity and the bridge is destroyed. The limited capacity of obstructive bridges or culverts, debris plugs at the culvert mouth or a combination of these factors retard floodflows and result in flooding upstream, erosion around the culvert entrance and bridge approach embankments and possible damage to the overlying roadbed.

In general, obstructions restrict floodflows and result in overbank flows and unpredictable areas of flooding; destruction of or damage to bridges and culverts; and, an increased velocity of flow immediately downstream. It is impossible to predict the degree or location of the accumulation of debris; therefore, for the purposes of this report, it was necessary to assume that there would be no accumulation of debris to clog any of the bridge or culvert openings in the development of the flood profiles.

The three small dams located in this reach of the Brandywine have no flood control capacities nor do they seriously alter flow characteristics of flood waters.

Brandywine Creek between the confluence of the East and West Branches and the lower end of the study reach is spanned by six bridges. Pertinent information on all bridges can be found in Table 6 on Page 17. Many of these bridges are obstructive to floodflows.

Flood damage reduction measures - There are no existing local or county zoning ordinances, building codes, or other regulatory measures specifically for the reduction of flood damages within the study area or the entire Brandywine Basin. However, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended, the Work Plan for the Brandywine Creek Watershed was prepared in April 1962. Since then, a Supplemental Work Plan has also been prepared for this watershed. These plans were prepared by the Chester County Commissioners; Chester County Soil and Water Conservation District; Chester County Water Resources Authority; New Castle (Delaware) Soil and Water Conservation District; Pennsylvania Department of Forests and Waters (now the Pennsylvania Department of Environmental Resources); Pennsylvania Fish Commission; and, the General State Authority of Pennsylvania. The Soil Conservation Service and the Forest Service of the U.S. Department of Agriculture assisted the sponsors in the development of the comprehensive plans.

Under these plans, the Soil Conservation Service has proposed the construction of ten dams in the Brandywine Basin. Four of the structures will be located within the West Branch with the other six located on the East Branch. All proposed structures will influence flows on the main stream study area. Pertinent information for these projects can be found in the Flood Plain Information Reports prepared for these sub-basins.

Studies of possible future floods on Brandywine Creek have been analyzed to show the effects of these proposed projects and are shown on Plates 9 and 10.

In addition, the Chester County Planning Commission, along with the Chester County Water Resources Authority and their consultants, have extensively studied planned land management within the Brandywine watershed to protect water resources of the basin. With the coming of urbanization to the Brandywine valley and development on the flood plain causing pollution and environmental deterioration, a plan to restrict such development in certain areas was proposed. The backbone of the plan was the proposed purchase of water resources protection rights in areas most critical to water resources. The Water Resources Authority would pay land owners not to develop some areas and to develop others. The plan would act as a supplement to zoning laws, in that they alone cannot guarantee protection for basin water resources and natural beauty, while at the same time compensating the owner for any loss in market value due to the control. The plan, although sound in idea, has not been fully accepted by all communities in the basin.

This Flood Plain Information Study has been requested so that it may be used as a basis for the development of flood plain management regulatory measures that are to be included in the Work Plan and zoning ordinances.

Other factors and their impacts - The impact of flooding along Brandywine Creek can be affected by the ability of local residents to anticipate and effectively react to a flood emergency. Efficient flood warning and forecasting systems can give home owners, business and industry valuable time to remove damageable materials from low-lying areas. Increased damages to downstream areas can also be reduced if floatable materials stored on the flood plain can be removed before being carried downstream to block bridge and culvert openings. Implementation of effective flood fighting and emergency evacuation plans can further reduce flood damages and the incidence of personal injury and death once the creek has reached flood stage.

Flood warning and forecasting - Inhabitants of the area depend entirely on the usual warnings issued through radio, television, and the local press media. The National Oceanic and Atmospheric Administration (NOAA) maintains year-round surveillance of weather conditions in the study area with stations at the Philadelphia and Wilmington Airports. Flood warnings and predicted flood peaks are issued by the NOAA Flood Forecasting Centers located at Harrisburg, Pennsylvania, and Trenton, New Jersey.

Flood fighting and emergency evacuation plans - Although there are no formal flood fighting or emergency evacuation plans for the Brandywine Basin, provisions for alerting area residents through local communications media and coordinating operations for Chester and Delaware Counties are accomplished by the County Civil Defense Office. This office maintains communications with the State Civil Defense Headquarters and the National Weather Service and establishes a "flood watch" during the earliest stages of a flood threat.

Flood fighting, evacuation and rescue activities are coordinated on a county-wide basis with local agencies.

Material storage on the flood plain - The developed areas of the flood plain along Brandywine Creek in the study area are occupied mainly by residential and commercial properties with few industries, and there is very little material stored on the flood plain. However, due to the intense industrial development along the East and West Branches of the Brandywine immediately upstream of the area under study, there are large quantities of materials stored on flood plain lands. Much of the material is floatable such as lumber, crates, and large volume lightweight containers. In addition, there are storage tanks and containers which may be unrestrained and buoyant. During time of floods, these floatable materials may be carried away by floodflows causing serious damage to structures downstream and clogging bridge openings creating more hazardous flooding problems.

PAST FLOODS

Summary of Historical Floods

Damaging floods have been reported to have occurred in the study area of Brandywine Creek as early as 1843 and 1899. Floods causing significant damage are reported to have occurred in 1915, 1920, 1927, 1933, 1942, 1950, two floods in 1955, 1960, and 1971. Of these, the March 5, 1920, flood was the highest flood of record at Chadds Ford, Pennsylvania, and the August 19, 1955, flood was the highest flood of record at Wilmington, Delaware.

Flood Records

Information on historical floods in Brandywine Creek was obtained from stream gaging stations maintained by the U.S. Geological Survey at Chadds Ford, Pennsylvania, and Wilmington, Delaware. The Chadds Ford gage has been in operation from 1911 to 1953 and again from 1962 to the present. The period of record for the Wilmington gage is 1946 to the present. High water marks of past floods were obtained, residents were interviewed, and newspaper files and historical documents were searched for information concerning past floods.

Crest stages and discharges for known floods at the gaging stations on the main stem of Brandywine Creek at Chadds Ford, Pennsylvania, and Wilmington, Delaware, are shown in Tables 2 and 3.

TABLE 2
FLOOD CREST ELEVATIONS
Brandywine Creek at Chadds Ford, Pennsylvania

Date of Crest	Estimated Peak Discharge (cfs)	Stage [a]	Elevation [b]
March 5, 1920	17,200	15.0	165.5
August 9, 1942	16,800	14.8	165.3
August 4, 1915	16,500	14.7	165.2
August 19, 1955	16,400 (c)	14.6 (c)	165.1 (c)
September 13, 1971	–	14.4 (d)	164.9 (d)
August 24, 1933	14,800	14.0	164.5

(a) Overbank flooding begins at a stage of 7.0 feet, as per U.S.G.S.
(b) Feet, mean sea level datum - Gage datum is 150.45 feet, mean sea level datum.
(c) Estimated value from gaging station data at Wilmington, Del.
(c) Preliminary estimate.

TABLE 3
FLOOD CREST ELEVATIONS
Brandywine Creek at Wilmington, Delaware

Date of Crest	Estimated Peak Discharge cfs	Stage [a]	Elevation [b]
August 19, 1955	17,800	13.9	82.1
September 13, 1971	21,300 (c)	13.8 (c)	82.0 (c)
August 13, 1955	12,600	11.8	80.0
September 13, 1960	15,600	11.4	79.7
November 25, 1950	11,500	11.3	79.6

(a) Overbank flooding begins at a stage of 8.5 feet, as per U.S.G.S.
(b) Feet, mean sea level datum - Gage datum is 68.23 feet, mean sea level datum.
(c) Preliminary Estimate.

Flood Descriptions

9 August 1942 - This is the second largest recorded flood at the Chadds Ford gaging station. Its peak of 16,800 cubic feet per second was only 400 cubic feet per second below that of the record 17,200 cubic feet per second recorded on 5 March 1920.

The flood was the result of unusually heavy rains occurring over the basin on 8 August and during the early hours of 9 August. Over 2 inches of rain fell between 7:00 a.m. and 8:00 a.m. on 9 August over the upper basin. Major damage in the upstream communities of Downingtown and Coatesville was recorded.

EXCERPTS FROM THE WILMINGTON MORNING NEWS, [a] 10 AUGUST 1942, RELATIVE TO THE FLOOD OF 9 AUGUST 1942

HUNDREDS OF THOUSANDS OF DOLLARS DAMAGE

Swirling waters inundate Chadd's Ford, Lenape Park; cause hundreds of thousands of dollars damage to Rockland Mill, homes and farms along river banks . . . The swirling waters spread out 3,000 feet wide at Chadd's Ford, flooding the first floors of about 18 houses in the town, and inundating the cellars of most others. The rise at this point was estimated at 15 feet. The Baltimore Pike, main north-south highway, was covered with four feet of rushing water at Chadd's Ford and hundreds of dead cattle, sheep and chickens floated across it as rescue workers paddled in row boats from house to house ferrying the occupants to points of safety . . . Estimates on precedent for yesterday's flood varied, but all agreed that it was the worst for a long time back. Several persons said that the water exceeded the height of the 1932 flood, and was equal to anything experienced up to 21 years ago. Another said that he had seen nothing like it in 65 years in the area.

[a] Simulated from newspaper clippings.

EXCERPTS FROM THE COATESVILLE RECORD, [a] 10 AUGUST 1942 RELATIVE TO THE FLOOD OF 9 AUGUST 1942

LENAPE PARK INUNDATED - DAMAGE HIGH

Lenape amusement park, where the east and west branches of Brandywine creek converge, had its heaviest flood in many years. The water at certain places was reported to be ten feet higher than normal. Hundreds of men, women and children, who were either staying in the many cabins at the park or were there for the day, were forced to flee for their lives when the swollen creek overflowed its banks and rushed through the park. . . In the park much damage was done to the $50,000 swimming pool and its bathhouses. The park's merry-go-round was a circular "island" surrounded by deep swirling water

19 August 1955 - By 15 August 1955, the Brandywine valley received approximately 7 inches of rainfall within a four-day period due to Hurricane Connie. Streams in the area overflowed their banks causing considerable damage to homes, businesses and roads throughout the area. While the ground was still saturated due to the heavy rainfall induced by Hurricane Connie, the area was again hit on 19 August by heavy rains caused by Hurricane Diane. Many areas had not recovered from the effects of Hurricane Connie and, as a result, were vulnerable to considerably more damage and devastation when hit by floodflows caused by Hurricane Diane.

EXCERPTS FROM THE WILMINGTON MORNING NEWS, [a] 20 AUGUST 1955

BRANDYWINE RIVER RECEDES, LEAVES DAMAGE IN WAKE

The Brandywine River, still a churning torrent from two hurricane-inspired downpours within less than a week, began receding rapidly yesterday, leaving unestimated damage to plants, homes and land along its banks . . . Reaching a peak flow of about 13 billion gallons between 6 and 7 a.m. yesterday, the creek started to recede shortly thereafter and by 4 p.m. it had gone down three feet and was continuing to fall at a rapid pace . . . Yesterday's peak flow, computed at the rate of from 18,000 to 20,000 cubic feet per second, was nearly twice the 7.4 billion gallon crest reached during Connie's onslaught . . . Although there are no figures to substantiate the theory, it is believed that the Connie and Diane floods of the current month were exceeded by the Brandywine's other famous double rampage of Aug. 9 and 13, 1942, causing hundreds of thousands of dollars worth of damage, including the loss of livestock by drowning. It also resulted in the death of at least five persons by drowning and lightning. . . Among the worst hit by the latest overflowing of the Brandywine's banks were: Chadds Ford, where six families had to be evacuated and flood waters in a store basement put food freezer equipment out of operation; Lenape Park, which was still covered by three feet of water yesterday morning, 12 hours after it flooded. . . Water was reported knee-deep in basements of most homes in the area. . . The Lexington Lumber Company, which had just replaced a stock of lumber ruined in last Saturday's floods, was hard hit again. Some of the lumber floated away. The company reported 23 inches of water throughout its plant Thursday night, compared to three inches last week-end. Lenape Park also went under water. The Lenape Inn, across the Brandywine from the park, reported about two feet of water in its yard and a thoroughly flooded basement.

[a] Simulated from newspaper clippings.

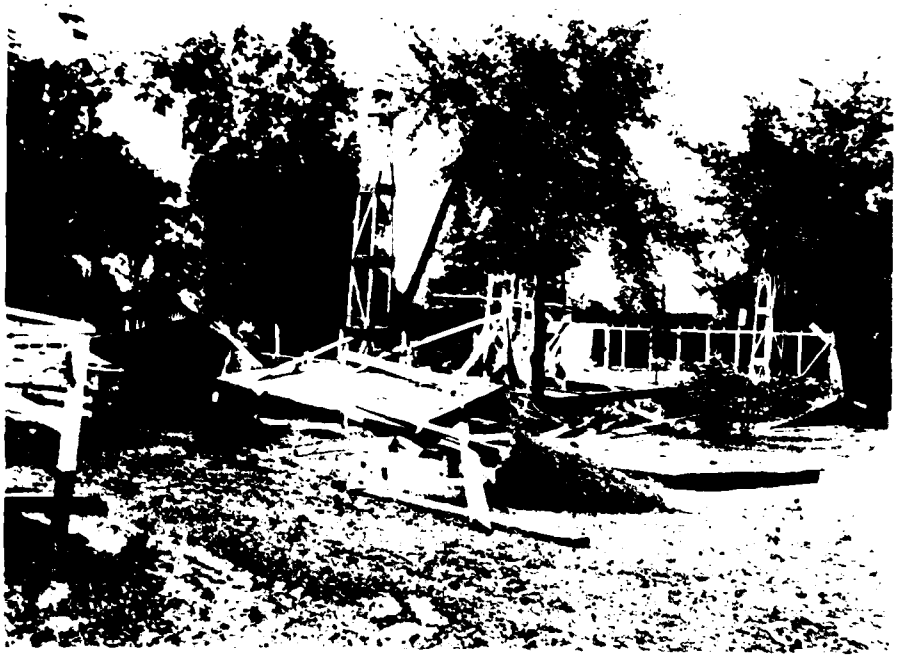
28 August 1971 - The rain which fell during the preceding week was welcomed as the rainfall for the month of August had been below normal and lawns, gardens and farms were in need of water. This general rain caused no great rise in streams as it was absorbed by the ground. Heavy rains began to fall throughout the Brandywine basin on August 27th and continued into the next day. No more water could be absorbed by the already-saturated ground and surface runoff caused streams in the area to rise rapidly and soon overflow their banks.

EXCERPTS FROM THE PHILADELPHIA INQUIRER, 29 AUGUST 1971, [a] RELATIVE TO THE FLOOD OF 29 AUGUST 1971

FLOODING PERILS ART

Rain-swollen Brandywine Creek endangered the Brandywine Museum at Chadds Ford Saturday afternoon before cresting 10 feet over normal. . . "Water came right up to our back door," said museum public relations director John Sheppard, "but it didn't come in." . . . The museum, a 111-year-old grist mill located right on the creek bank, houses 170 paintings, most of them priceless works of the Andrew Wyeth family. . . Sheppard said museum officials were forced to close the structure's lower level and put up large steel guards over doors on the creek side of the building. . . About 1,500 persons visited the museum during the day, Sheppard said, "Most of them didn't know what was happening."

[a]Simulated from newspaper clippings.



FIGURES 1 AND 2 - Destruction caused by the 9 August 1942 flood at Lenape Park

FIGURE 3 - Cottages at Lenape, Pennsylvania, that were inundated by the 9 August 1942 flood.

FUTURE FLOODS

Floods of the same or larger magnitude as those that have occurred in the past could occur in the future. Larger floods have been experienced in the past on streams with similar geographical and physiographical characteristics as those found in the study area. Similar combinations of rainfall and runoff which caused these floods could occur in the study area. Therefore, to determine the flooding potential of the study area, it was necessary to consider storms and floods that have occurred in regions of like topography, watershed cover, and physical characteristics. Discussion of the future floods in this report is limited to those that have been designated as the Intermediate Regional Flood and the Standard Project Flood. The estimates of the Intermediate Regional Flood and the Standard Project Flood as presented in this report are based on the existing development of the watershed since future changes within the basin cannot be accurately predicted. The Standard Project Flood represents a reasonable upper limit of expected flooding in the study area. The Intermediate Regional Flood may reasonably be expected to occur more frequently although it will not be as severe as the infrequent Standard Project Flood.

Intermediate Regional Flood

The Intermediate Regional Flood is defined as one that occurs once in 100 years on the average, although it could occur in any year. The peak flow of this flood was developed from statistical analyses of streamflow records at Chadds Ford, Pennsylvania, and Wilmington, Delaware, in conjunction with regional synthetic analyses at selected locations along the main stream. Peak flows thus developed for the Intermediate Regional Flood at selected locations in the study area are shown in Table 4. Also presented in Table 4 are discharges for the same flood with all proposed Soil Conservation Service Dams in operation.

Standard Project Flood

The Standard Project Flood is defined as a major flood that can be expected to occur from a severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the study area is located, excluding extremely rare combinations. The Corps of Engineers, in cooperation with the NOAA Weather Service, has made comprehensive studies and investigations based on the past records of experienced storms and floods and has developed generalized procedures for estimating the flood potential of streams. Peak discharges for the Standard Project Flood at selected locations in the study area are shown in Table 4 along with discharges as modified by proposed Soil Conservation Service Dams. A discharge hydrograph for the Standard Project Flood at Chadds Ford, Pennsylvania, is shown on Plate 13. The relative water surface

elevations for the Intermediate Regional Flood and the Standard Project Flood are shown on Plates 7 and 8. Plates 9 and 10 represent water surface elevations for both floods as modified by all proposed Soil Conservation Service Dams in operation.

TABLE 4

PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS

Location	River Mile	Drainage Area	Intermediate Regional Flood Discharge		Standard Project Flood Discharge	
			Natural	With Soil Conserv. Service Dams	Natural	With Soil Conserv. Service Dams
		sq mi	cfs	cfs	cfs	cfs
Upstream of the Pennsylvania - Delaware State Boundary	10.6	299.9	24,600	19,200	68,400	53,300
Chadds Ford Gage	14.8	287.0	24,000	18,700	63,100	49,200
Upstream of Confluence with Radley Run	17.8	268.4	23,400	18,300	59,400	46,300
At Confluence of East and West Branches of Brandywine Creek	20.3	257.9	22,300	17,400	52,100	40,600

Table 5 shows comparisons of flood elevations for the Intermediate Regional Flood and the Standard Project Flood with the highest recorded floods at Chadds Ford, Pennsylvania.

TABLE 5
COMPARISON OF FLOOD ELEVATIONS
Brandywine Creek at Chadds Ford, Pennsylvania

Flood	Elevation [a]	
	Natural	With Soil Conservation Service Dams
Standard Project	177.0	174.1
Intermediate Regional	167.7	165.2
March 5, 1920	165.45	-----
August 9, 1942	165.25	-----

[a] Feet, mean sea level datum.

Frequency

A frequency curve of peak flows was developed from available recorded annual peaks. The curve presents the frequency of floodflows up to the magnitude of once in 100 years (Intermediate Regional Flood). Frequencies of floods equivalent to the Standard Project Flood and larger can be obtained through extrapolation of the curve, but it is not

practical to assign a frequency to such large flows as their occurrence is so extremely rare. The curve, which is available upon request, reflects the judgment of engineers who have studied the area and are familiar with the region; however, it must be regarded as approximate and should be used with caution in connection with any planning of flood plain use.

Hazards of Large Floods

The extent of damage caused by any flood depends on the topography of the area flooded, depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. An Intermediate Regional or Standard Project Flood on Brandywine Creek would result in the inundation of residential, commercial, and industrial properties in the study area. Deep floodwater flowing at high velocity and carrying floating debris would create conditions hazardous to persons and vehicles attempting to cross flooded areas. In general, floodwater 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep an adult person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately destroyed, or in vehicles that are ultimately submerged or floated. Water lines can be ruptured by deposits of debris and the force of floodwaters, thus creating the possibility of contaminated domestic water supplies. Damaged sanitary sewer lines and sewage treatment plants could result in the pollution of floodwaters creating health hazards. Isolation of areas by floodwater could create hazards in terms of medical, fire, or law enforcement emergencies.

Flooded areas and flood damages - The areas along the study reach of Brandywine Creek that would be flooded by the Standard Project Flood are shown on Plate 2, which is also an index map to Plates 3 through 6. Areas that would be flooded by the Intermediate Regional Flood and the Standard Project Flood are shown in detail on Plates 3 through 6. The actual limits of these overflow areas may vary somewhat from those shown on the maps because the 10-foot contour interval and scale of the maps do not permit precise plotting of the flooded area boundaries. As may be seen from these plates, floodflows from the main stem of Brandywine Creek inundate Chadds Ford and other small communities adjacent to the stream. The areas that would be flooded by the Intermediate Regional and Standard Project Floods include commercial and residential properties, along with associated streets and roads. Considerable damage to the facilities would occur during an Intermediate Regional Flood. However, due to the wider extent, greater depths of flooding, higher velocity flow and longer duration of flooding during a Standard Project Flood, damage would be more severe than during an Intermediate Regional Flood. Plates 7 and 8 show the water surface profile for the Intermediate Regional and Standard Project Floods. Plates 9 and 10 show the water surface profile for the same floods as modified by the proposed Soil Conservation Service Dams. Depth of flow in the channel can be estimated from these illustrations. Cross sections of the flood plain at selected locations, together with the water surface elevation and lateral extent of the Intermediate Regional and the Standard Project Floods are shown on Plates 11 and 12.

Obstructions - During floods, debris collecting on bridges and culverts could decrease their carrying capacity and cause greater water depths (backwater effect) upstream of these structures. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the structures were considered in preparing profiles of the Intermediate Regional and Standard Project Floods. Similarly, the maps of flooded areas show the backwater effect of obstructive bridges and culverts, but do not reflect increased water surface elevation that could be caused by debris collecting against the structures, or by deposition of silt in the stream channel under structures. As previously indicated, there are 3 dams within the study area which have no flood control capacities nor will they seriously alter flow characteristics of floodwaters. Of the 6 bridges crossing the stream in the study area, most of them are obstructive to the Intermediate Regional Flood and all are obstructive to the Standard Project Flood. Table 6 shows water surface elevations at these bridges.

TABLE 6
ELEVATION DATA
Bridges Across Brandywine Creek in Study Area

Identification	Mileage Above Mouth	Under-clearance Elev. (a)	Water Surface Elevation[a]			
			Intermediate Regional Flood		Standard Project Flood	
			Natural	With Soil Conserv. Service Dams	Natural	With Soil Conserv. Service Dams
Smith's Bridge	10.47	150.6	154.0	149.2	164.9	161.4
Pa. - Del. Rt. 100	13.30	171.7 (b)	162.7	159.9	173.0	169.8
Penn Central R.R.	14.87	169.0	167.7	165.2	177.4	175.0
Baltimore Pike, U.S. Rt. 1	15.10	170.0	168.5	165.9	178.0	175.9
Street Rd., Pa. Rt. 926	17.89	176.6	176.1	174.6	185.1	182.6
Lenape Rd., Pa. Rt. 52	19.07	180.8	180.6	179.2	189.4	187.3

(a) Feet, mean sea level datum on upstream side of bridge.
(b) Indicates average elevation.

Velocities of flow - Water velocities during floods depend largely on the size and shape of the cross sections, conditions of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream. During an Intermediate Regional Flood, velocities of main channel flow in the study area would be 5 to 6 feet per second. Water flowing at this rate is capable of causing severe erosion to streambanks and fill around bridge abutments and transporting large objects. It is expected that velocity of main channel flow during a Standard Project Flood would be slightly higher than during an Intermediate Regional Flood. Overbank flow in the study area would average 2 to 4 feet per second. Water flowing at 2 feet per second or less would deposit debris and silt. Table 7 lists the maximum velocities that would occur in the main channel and overbank areas of Brandywine Creek in the study area during the Intermediate Regional and the Standard Project Floods.

TABLE 7
MAXIMUM VELOCITIES
Brandywine Creek in Study Area

Location	Mileage Above Mouth	Maximum Velocities							
		Intermediate Regional Flood				Standard Project Flood			
		Natural		With Soil Conservation Service Dams		Natural		With Soil Conservation Service Dams	
		Channel	Overbank	Channel	Overbank	Channel	Overbank	Channel	Overbank
		ft/sec	ft/sec	ft/sec	ft/sec	ft/sec	ft/sec	ft/sec	ft/sec
Cross Section No. 1 approximately 1 mile above Pa.-Del. Border	11.5	6	2	6	2	9	3	8	3
Cross Section No. 8, approximately 1 mile above Pa. Rt. 52	19.9	6	3	4	2	8	4	7	4

Rates of rise and duration of flooding - Intense rainfalls that accompany severe storm fronts usually produce the floods occurring in the Brandywine basin. There is a time lag of several hours before overbank flooding occurs along the main stream. Floods generally rise slowly and stay out of banks for long periods of time. Table 8 gives the maximum rate of rise, height of rise (from critical stage level to maximum floodflow level), time of rise (time period corresponding to height of rise), and duration of critical stage (period of time flooding is above critical stage level) for the Standard Project Flood and the flood of August 9, 1942, at Chadds Ford, Pennsylvania.

TABLE 8
RATES OF RISE AND DURATION
Brandywine Creek at Chadds Ford, Pennsylvania

Flood	Maximum Rate of Rise	Height of Rise	Time of Rise	Duration of Critical Stage
	ft/hr	ft	hrs	hrs
Standard Project	2.9	21.3	10	50
August 9, 1942	1.9	7.8	6	20

Photographs, future flood heights - The levels that the Intermediate Regional and Standard Project Floods are expected to reach at various locations along Brandywine Creek are indicated on the following photographs.

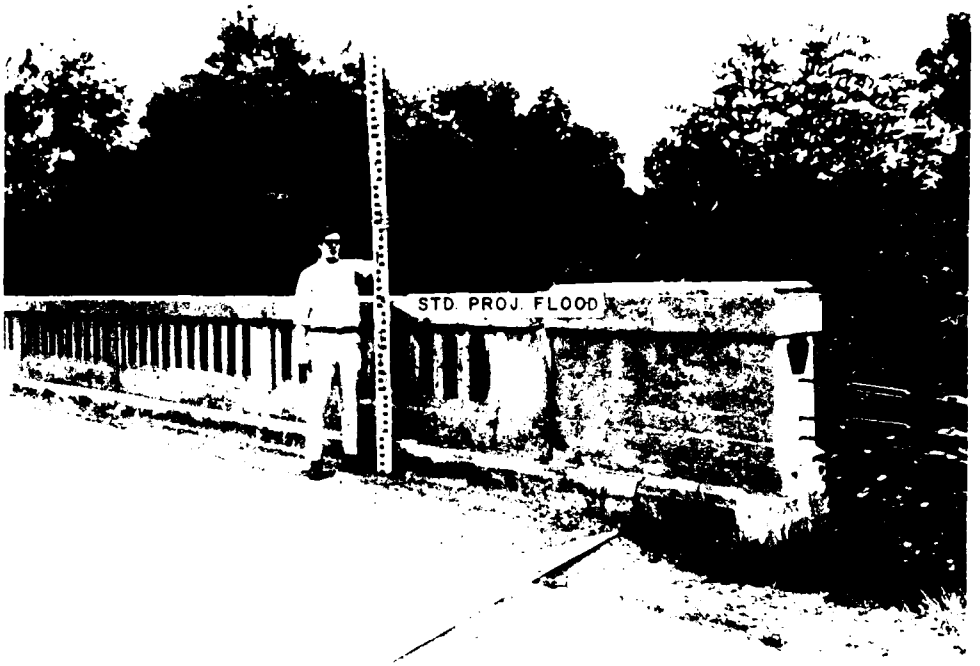


FIGURE 4 - Future flood height on Baltimore Pike (U.S. Route 1), at Chadds Ford, Pa.

FIGURE 5 - Future flood heights at Pa. Rt. 926 in Pocopson, Pa. The Standard Project Flood would be 3.7 feet above top of rod.

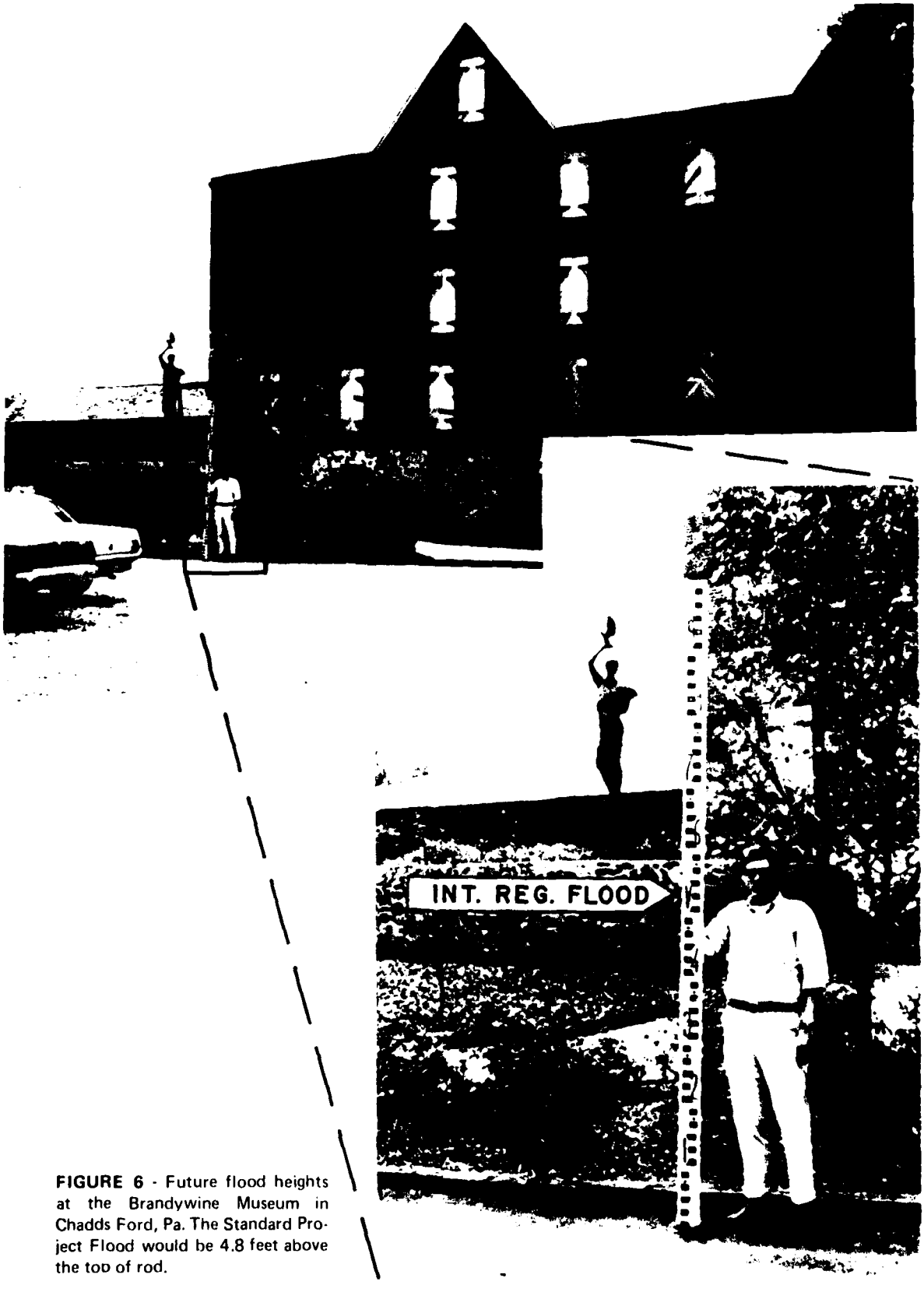


FIGURE 6 - Future flood heights at the Brandywine Museum in Chadds Ford, Pa. The Standard Project Flood would be 4.8 feet above the top of rod.

FIGURE 7 - Future flood heights at the Lenape Inn. The Standard Project Flood would be 0.7 foot above top of rod.

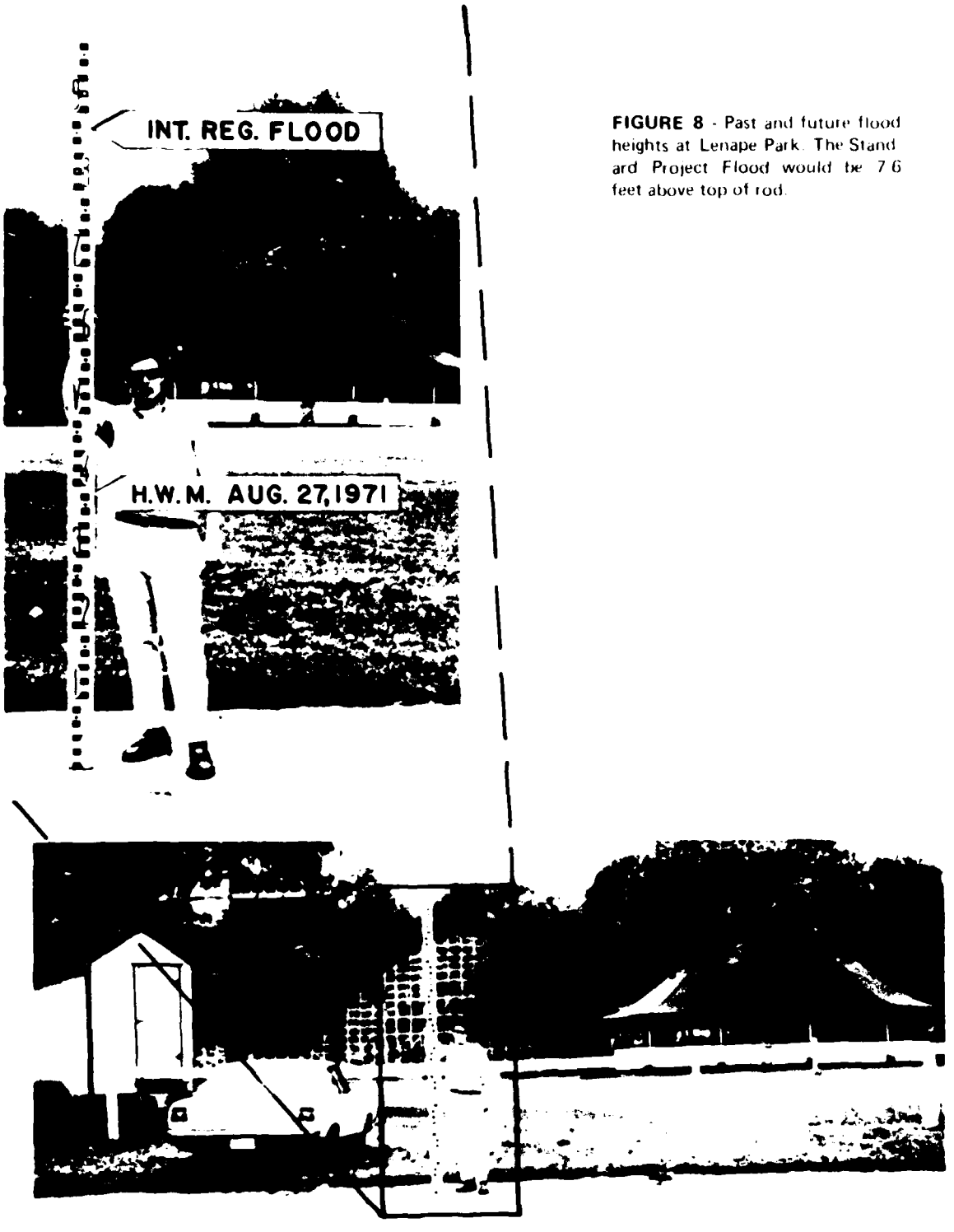


FIGURE 8 - Past and future flood heights at Lenape Park. The Standard Project Flood would be 7.6 feet above top of rod.

GLOSSARY

Backwater. The resulting high water surface in a given stream due to a downstream obstruction or high stages in an intersecting stream.

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, ocean, lake, or other body of standing water.

Normally a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased stream flow, and other problems.

Flood Crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Plain. The areas adjoining a river, stream, watercourse, ocean, lake, or other body of standing water that have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Hurricane. An intense cyclonic windstorm of tropical origin in which winds tend to spiral inward in a counterclockwise direction toward a core of low pressure, with maximum surface wind velocities that equal or exceed 75 miles per hour (65 knots) for several minutes or longer at some points. Tropical storm is the term applied if maximum winds are less than 75 miles per hour.

Hydrograph. A graph showing flow values against time at a given point, usually measured in cubic feet per second. The area under the curve indicates total volume of flow.

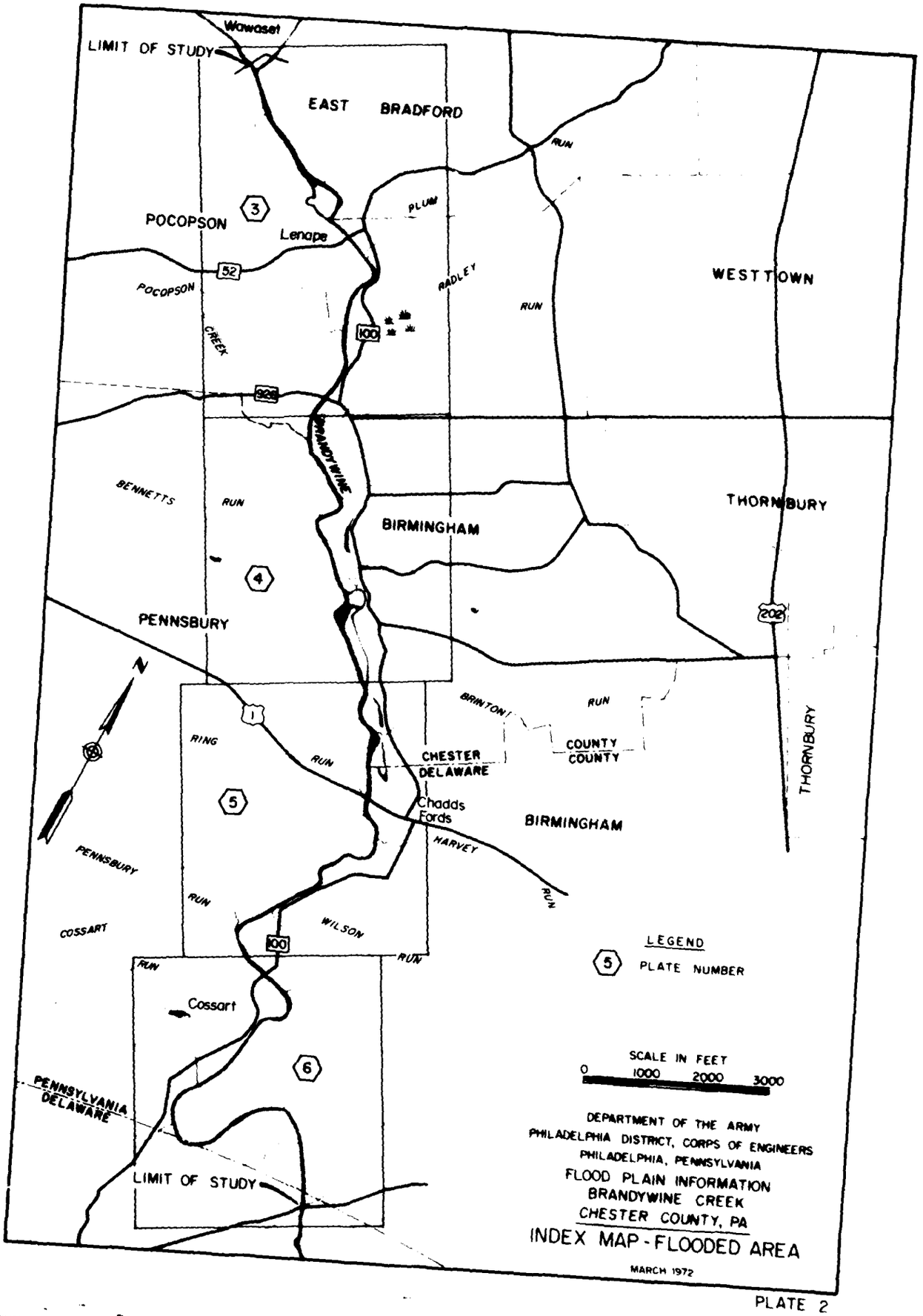
Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the general region of the watershed.

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40-60 percent of the Probable Maximum Floods for the same basins. As used by the Corps of Engineers, Standard Project Floods are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance Elevation. The elevation at the top of the opening of a culvert, or other structure through which water may flow along a watercourse.



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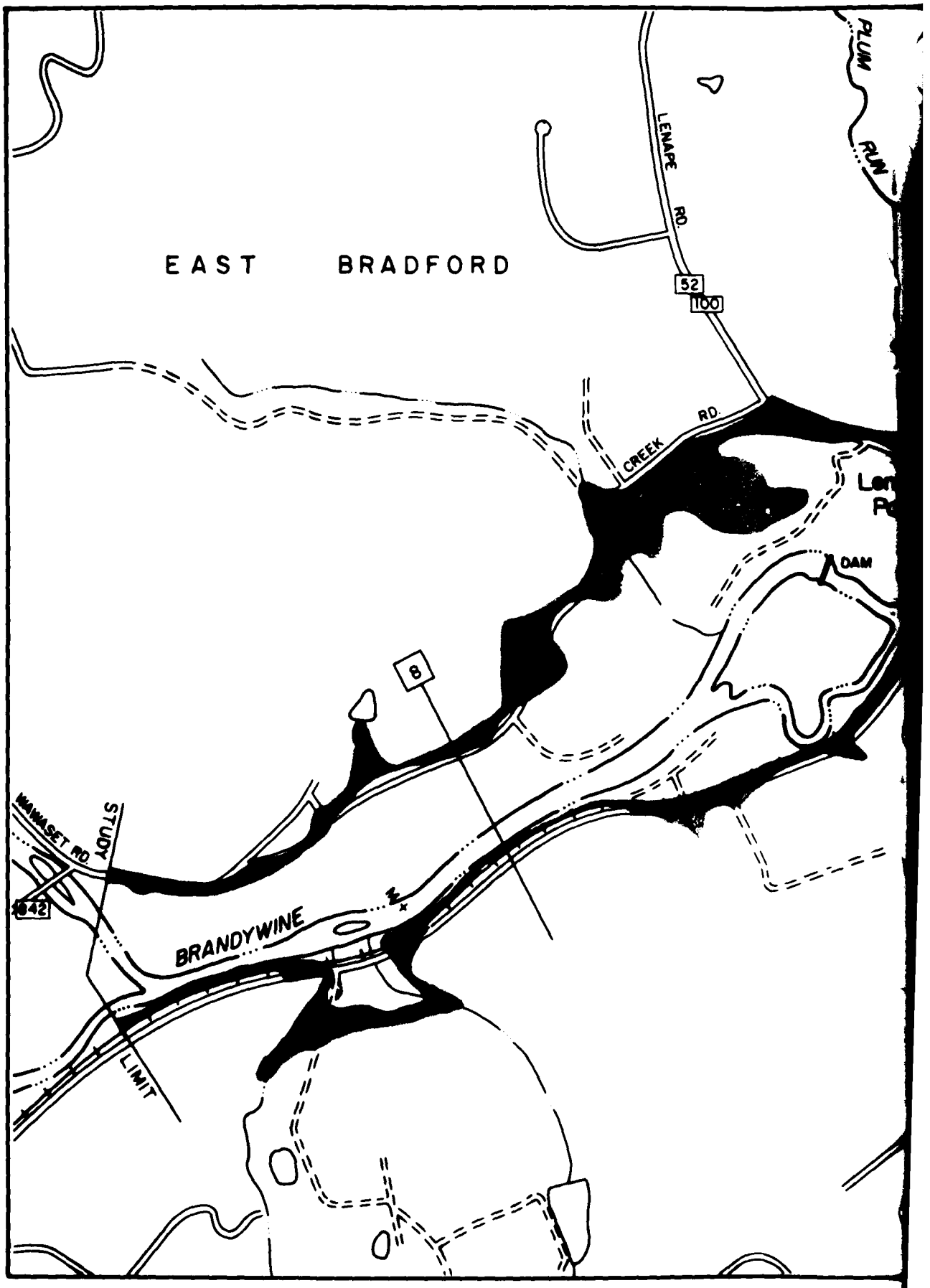
PHILADELPHIA, PENNSYLVANIA

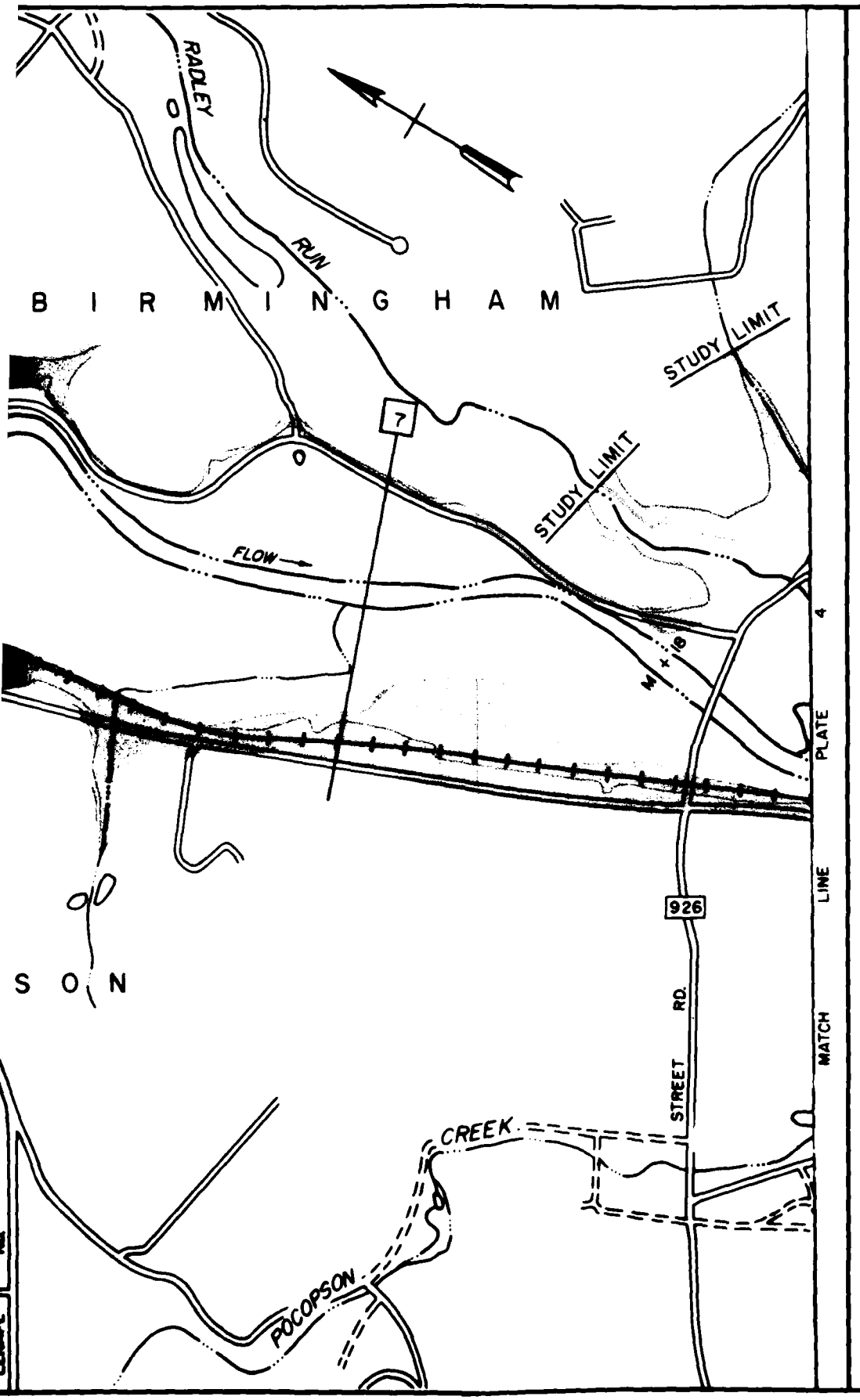
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA

INDEX MAP - FLOODED AREA

MARCH 1972

PLATE 2


EAST BRADFORD
PLUM RUN
LENAPE RD.
52
100
CREEK RD.
DAM
B
WAWASET RD.
STUDY LIMIT
1042
BRANDYWINE



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD	STANDARD PROJECT FLOOD

M+20 MILES ABOVE MOUTH

8 CROSS SECTION

GROUND ELEVATION IN FEET (U
G S 1929 ADJ.) SEA LEVEL DATU

CHANNEL

TOWNSHIP LIMITS

926 STATE HIGHWAY

NOTES

1 MAP BASED ON U S G S 7.5 MIN QUADRAN
SHEETS UNIONVILLE 1953, WEST CHESTER
& WILMINGTON NORTH, DEL. 1954 MINOR
ADDITIONS AND ADJUSTMENTS MADE BY
CORPS OF ENGINEERS.

2. LIMITS OF OVERFLOW SHOWN MAY VARY
FROM ACTUAL LOCATION ON GROUND A
EXPLAINED IN THE REPORT.

3 AREAS OUTSIDE THE FLOODPLAIN MAY B
SUBJECT TO FLOODING FROM LOCAL RU

4 MINIMUM CONTOUR INTERVAL IS 10 FT.

SCALE IN FEET
0 800 1600

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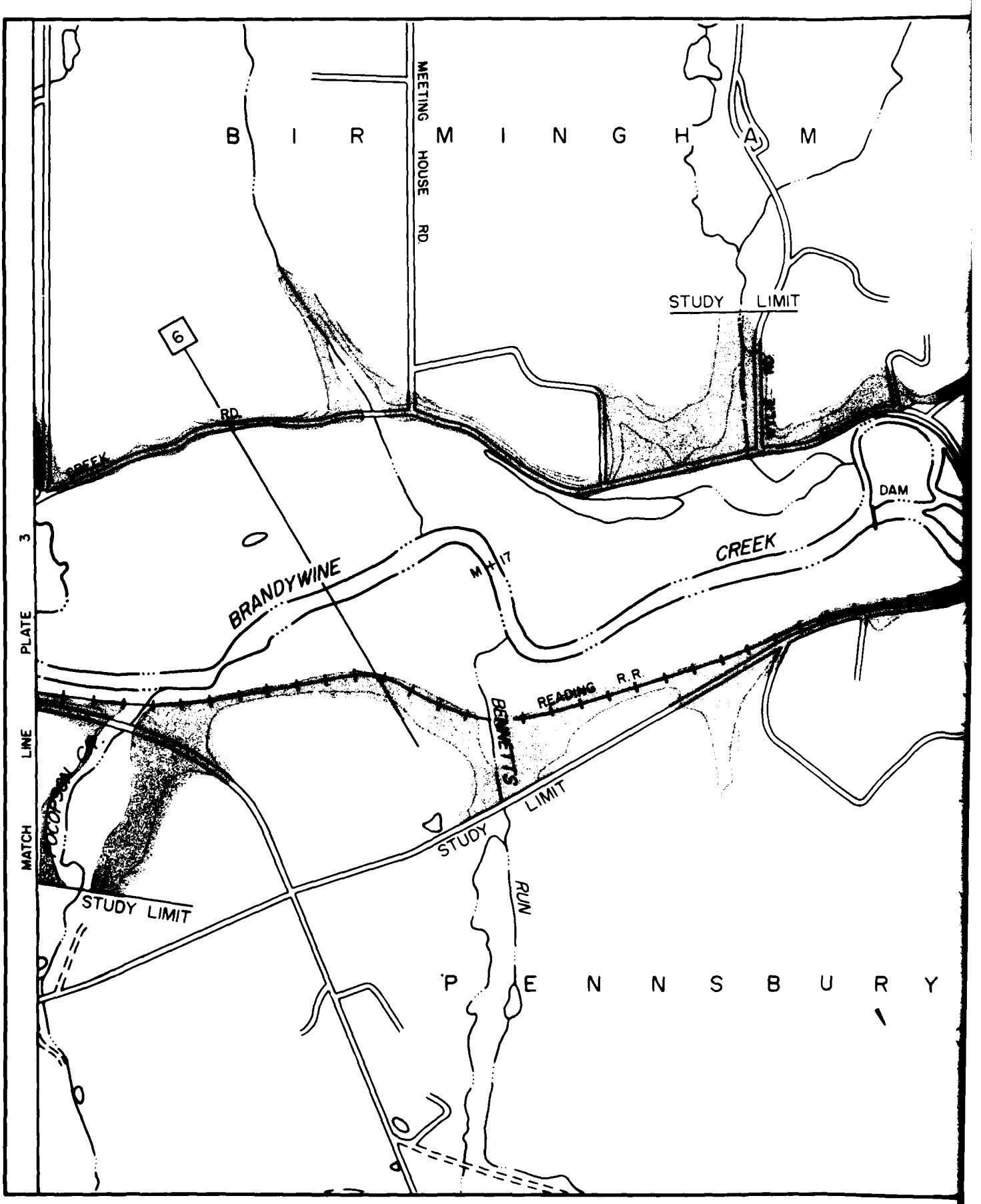
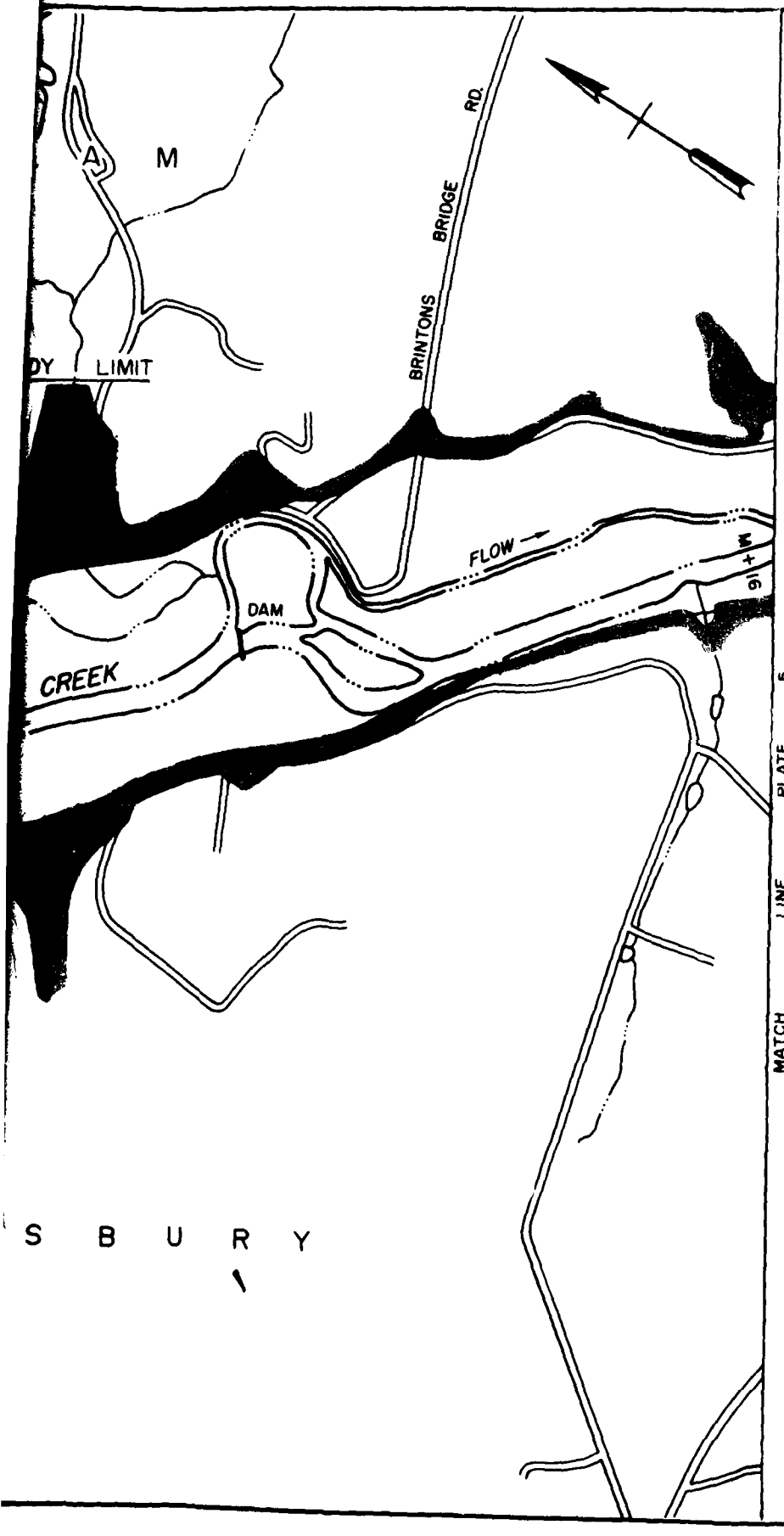
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA.

FLOODED AREAS

MARCH 1972


BIRMINGHAM
MEETING HOUSE RD.
STUDY LIMIT
6
RD.
CREEK
DAM
BRANDYWINE
CREEK
M-117
READING R.R.
BENNETTS
RUN
STUDY LIMIT
STUDY LIMIT
PENNSBURY
MATCH LINE
PLATE 3



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+17 MILES ABOVE MOUTH

6 CROSS SECTION

GROUND ELEVATION IN FEET (USC & GS 1929 ADJ.) SEA LEVEL DATUM

CHANNEL

TOWNSHIP LIMITS

NOTES

1. MAP BASED ON U.S.G.S. 7.5 MIN QUADRANGLE SHEETS UNIONVILLE 1953, WEST CHESTER 1954, & WILMINGTON NORTH, DEL. 1954. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOODPLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF
4. MINIMUM CONTOUR INTERVAL IS 10 FT

SCALE IN FEET
0 800 1600

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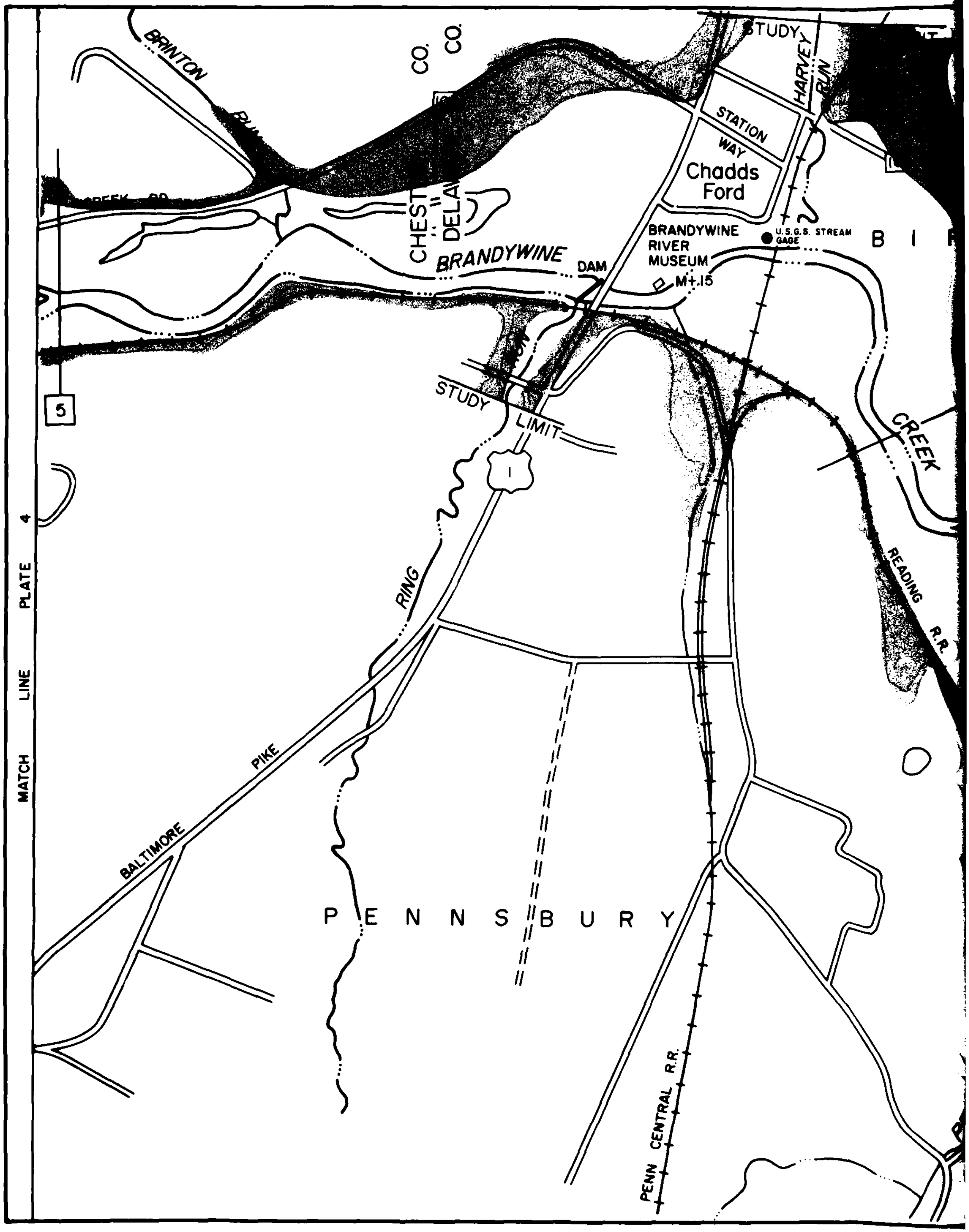
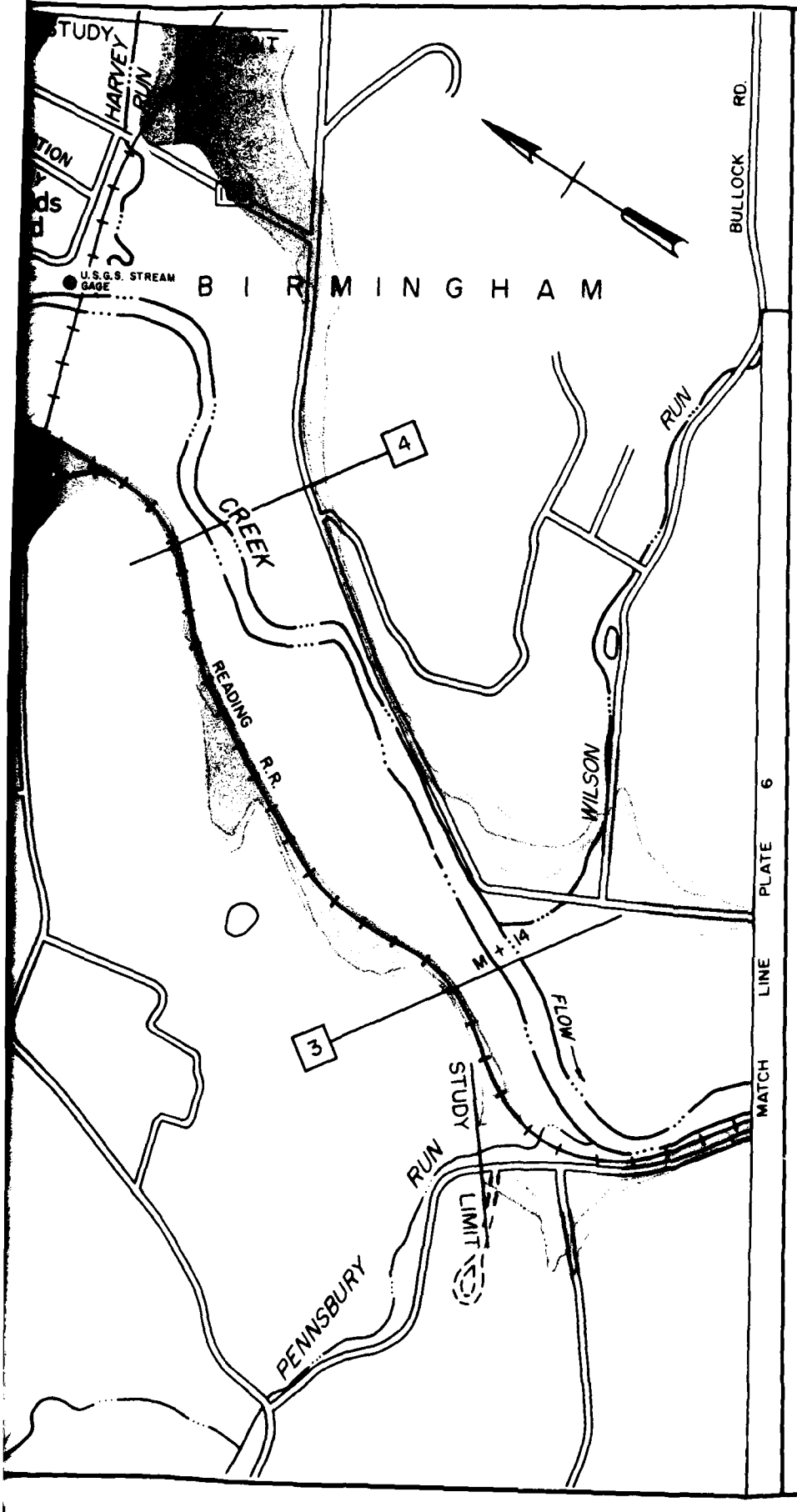
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA.
FLOODED AREAS

MARCH 1972

PLATE 4



MATCH LINE PLATE 4
5
BRINTON
RUN
CREEK RD
CO.
CO.
CHEST
DELA
BRANDYWINE
DAM
STUDY
HARVEY RUN
STATION WAY
Chadds Ford
BRANDYWINE RIVER MUSEUM
U.S.G.S. STREAM GAGE
M+.15
B I
STUDY LIMIT
1
CREEK
RING
READING R.R.
BALTIMORE PIKE
P E N N S B U R Y
PENN CENTRAL R.R.



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+15 — MILES ABOVE MOUTH

3 — CROSS SECTION

GROUND ELEVATION IN FEET (USC & GS 1929 ADJ.) SEA LEVEL DATUM

CHANNEL

COUNTY OR TOWNSHIP LIMITS

100 — STATE HIGHWAY

1 — U.S. HIGHWAY

NOTES

1. MAP BASED ON USGS 7.5 MIN QUADRANGLE SHEETS UNIONVILLE 1953, WEST CHESTER 1954, & WILMINGTON NORTH, DEL. 1954. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
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SCALE IN FEET
0 800 1600

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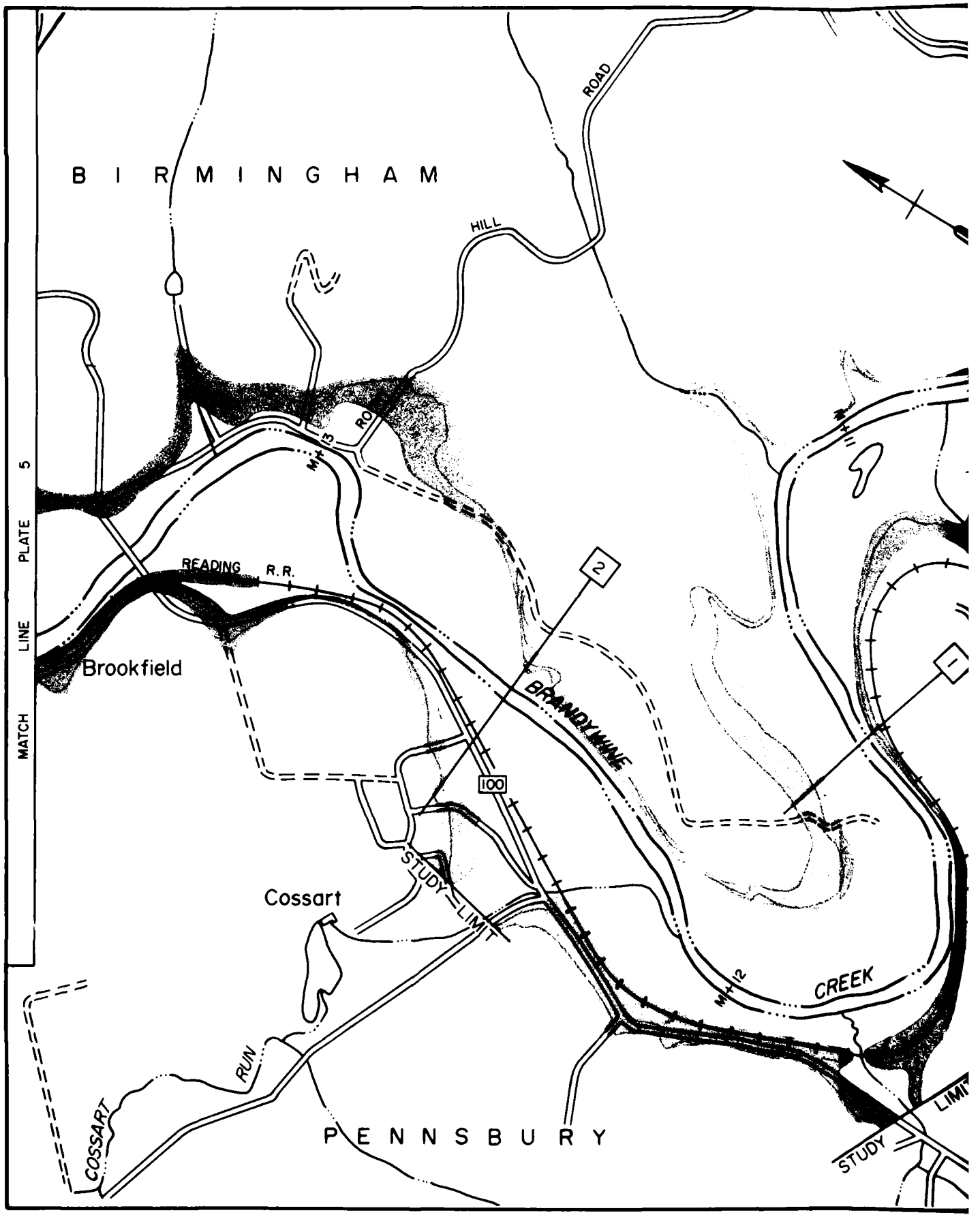
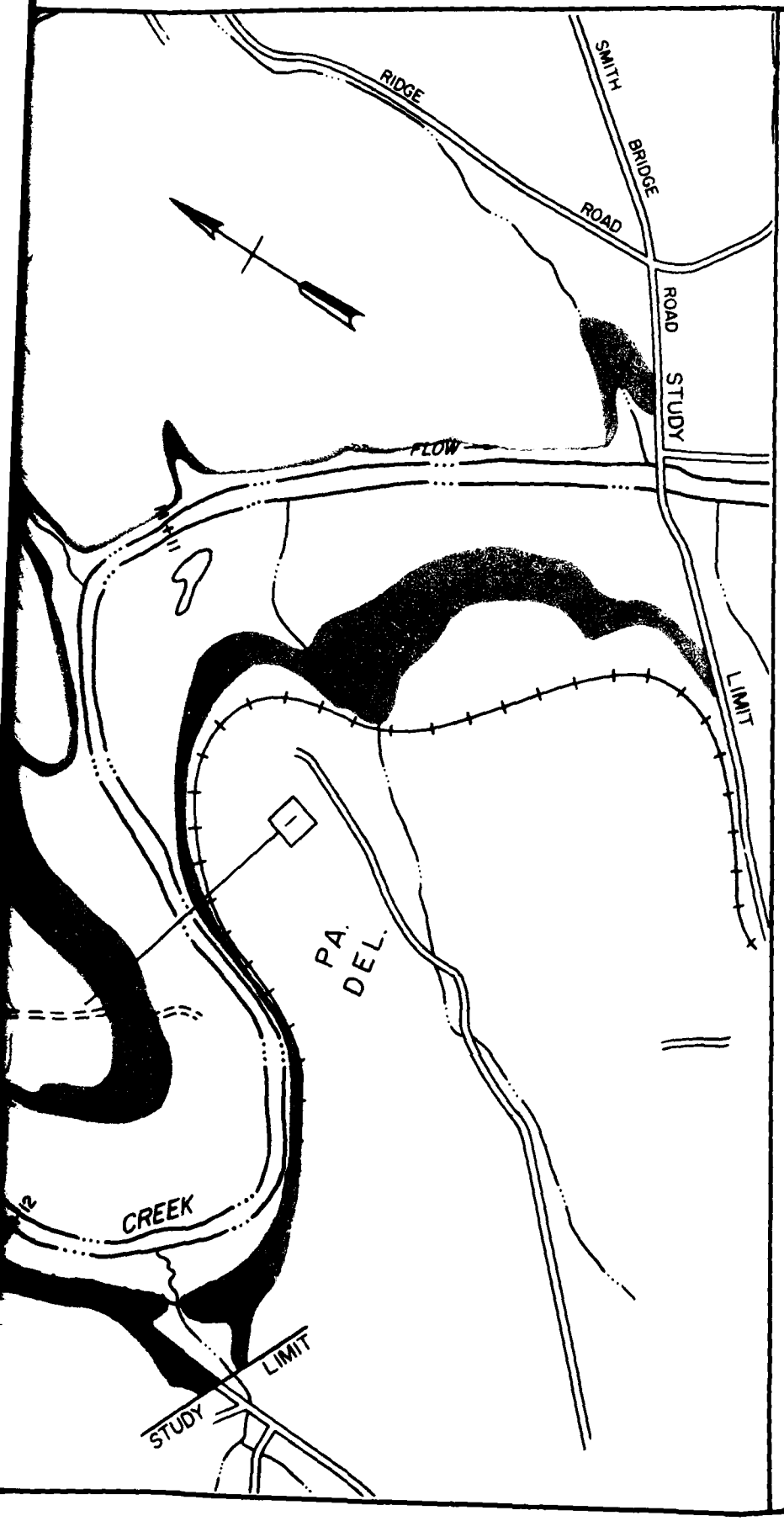
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA
FLOODED AREAS

MARCH 1972

PLATE 5


BIRMINGHAM
ROAD
HILL
RO
READING R.R.
Brookfield
BRANDYWINE
100
STUDY LIMIT
Cossart
RUN
COSSART
PENNSBURY
CREEK
STUDY
MATCH LINE PLATE 5



LEGEND

OVERFLOW LIMITS

INTERMEDIATE REGIONAL FLOOD — STANDARD PROJECT FLOOD

M+12 MILES ABOVE MOUTH

1 CROSS SECTION

GROUND ELEVATION IN FEET (U S C & G S 1929 ADJ.) SEA LEVEL DATUM

CHANNEL

STATE OR TOWNSHIP LIMITS

100 STATE HIGHWAY

NOTES

1. MAP BASED ON U S G S. 7.5 MIN. QUADRANGLE SHEETS UNIONVILLE 1953, WEST CHESTER 1954, & WILMINGTON NORTH, DEL. 1954. MINOR ADDITIONS AND ADJUSTMENTS MADE BY CORPS OF ENGINEERS.
2. LIMITS OF OVERFLOW SHOWN MAY VARY FROM ACTUAL LOCATION ON GROUND AS EXPLAINED IN THE REPORT.
3. AREAS OUTSIDE THE FLOODPLAIN MAY BE SUBJECT TO FLOODING FROM LOCAL RUNOFF
4. MINIMUM CONTOUR INTERVAL IS 10 FT

SCALE IN FEET

0 800 1600

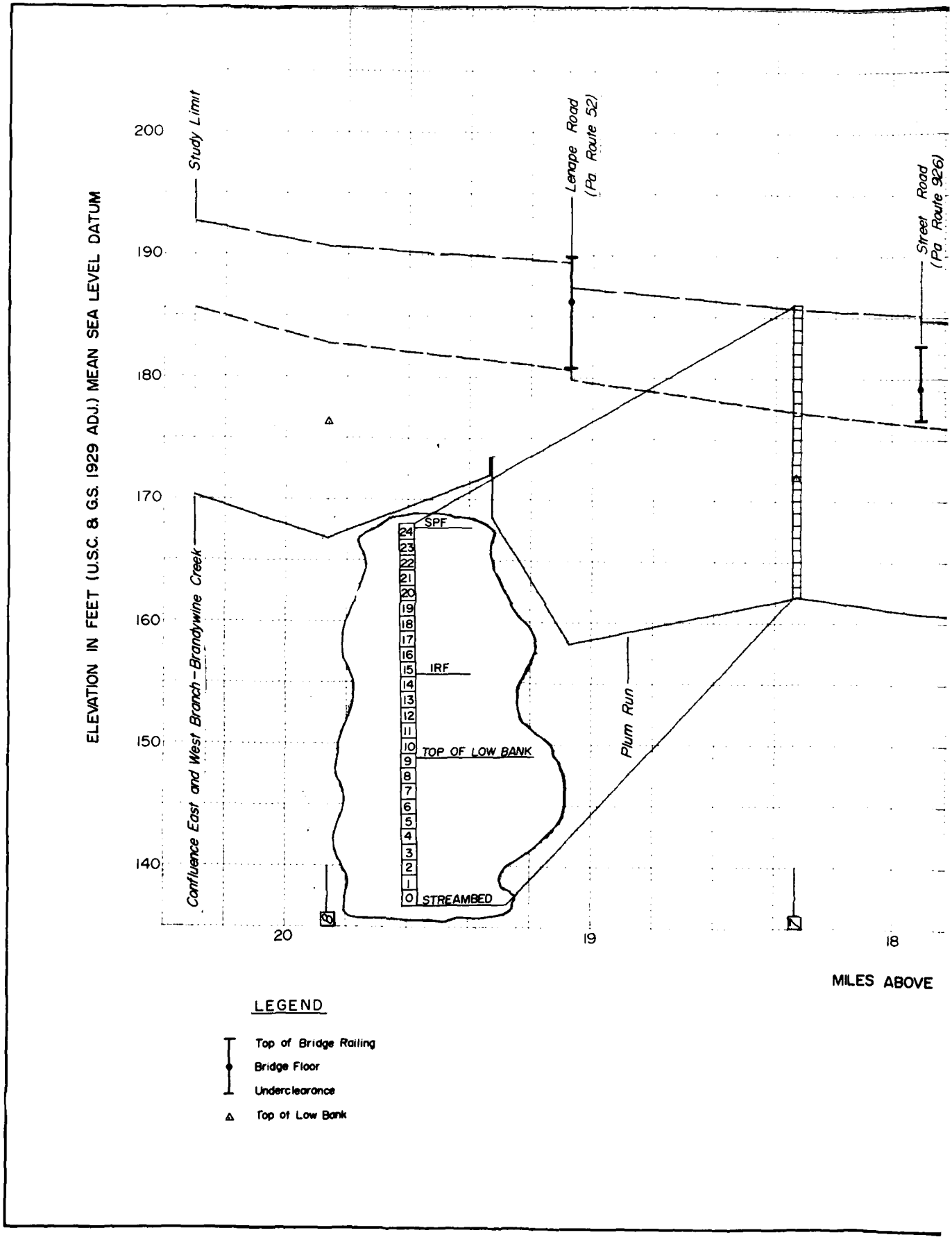
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

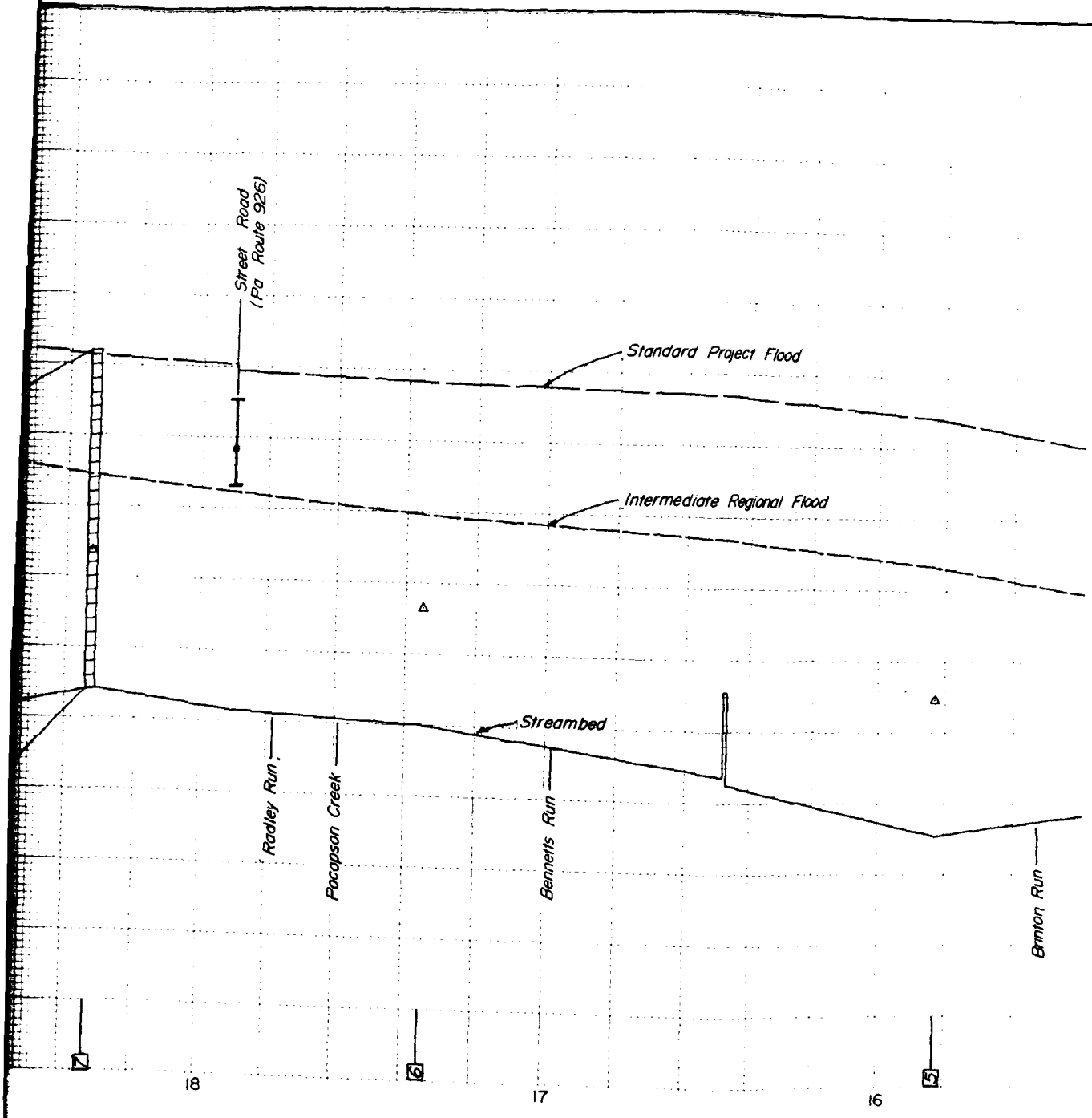
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA.

FLOODED AREAS

MARCH 1972

PLATE 6


ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) MEAN SEA LEVEL DATUM
200
190
180
170
160
150
140
Study Limit
Lenape Road (Pa Route 52)
Street Road (Pa Route 926)
Confluence East and West Branch-Brandywine Creek
Plum Run
SPF
IRF
TOP OF LOW BANK
STREAMBED
20
19
18
MILES ABOVE
LEGEND
Top of Bridge Railing
Bridge Floor
Underclearance
Top of Low Bank



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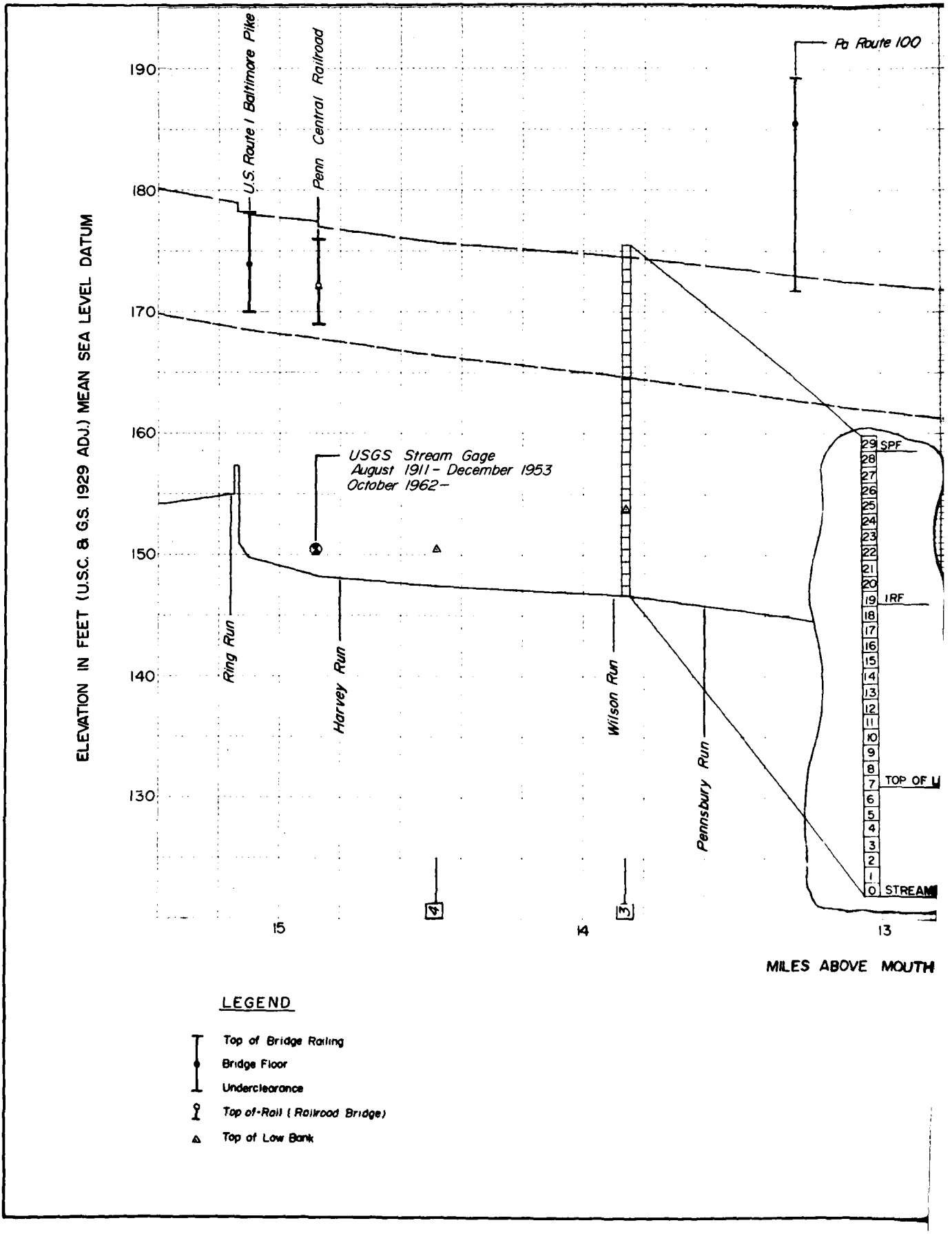
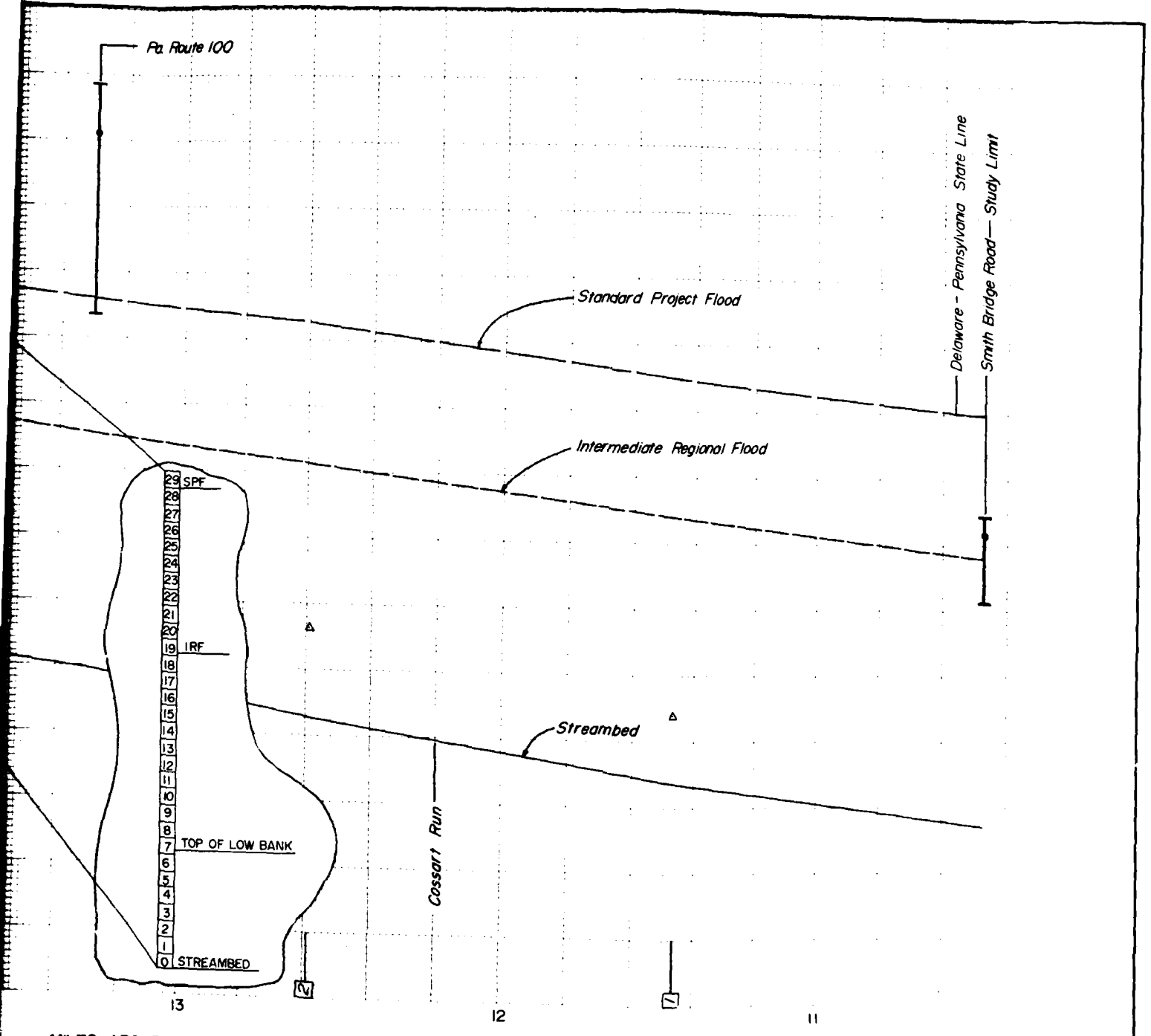
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA.

HIGH WATER PROFILE
MARCH 1972

PLATE 7


ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) MEAN SEA LEVEL DATUM
190
180
170
160
150
140
130
U.S. Route 1 / Baltimore Pike
Penn Central Railroad
Pa Route 100
USGS Stream Gage
August 1911 - December 1953
October 1962 -
Ring Run
Harvey Run
Wilson Run
Pennsbury Run
SPF
IRF
TOP OF U
STREAM
15
14
13
MILES ABOVE MOUTH
LEGEND
Top of Bridge Railing
Bridge Floor
Underclearance
Top of-Rail (Railroad Bridge)
Top of Low Bank



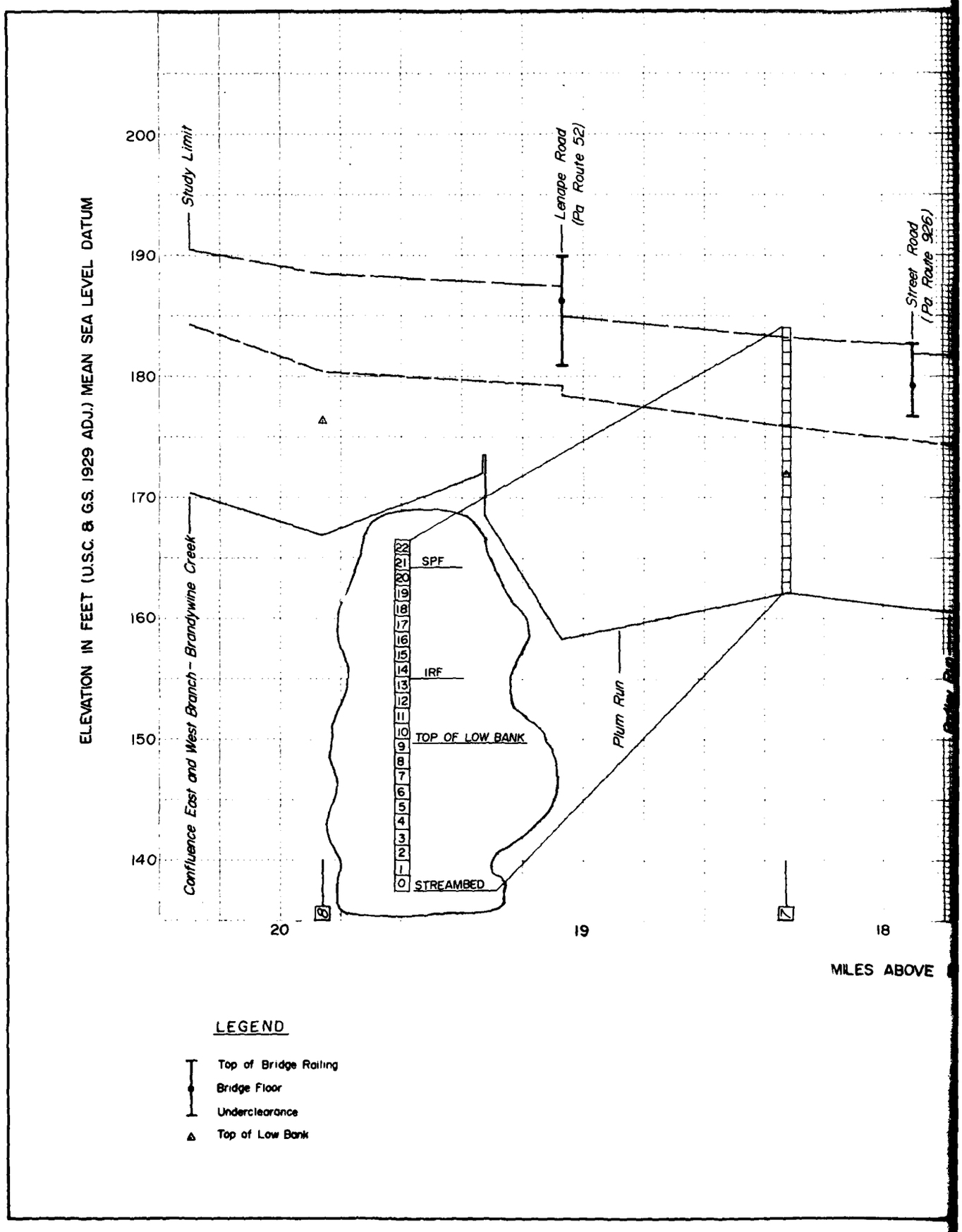
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

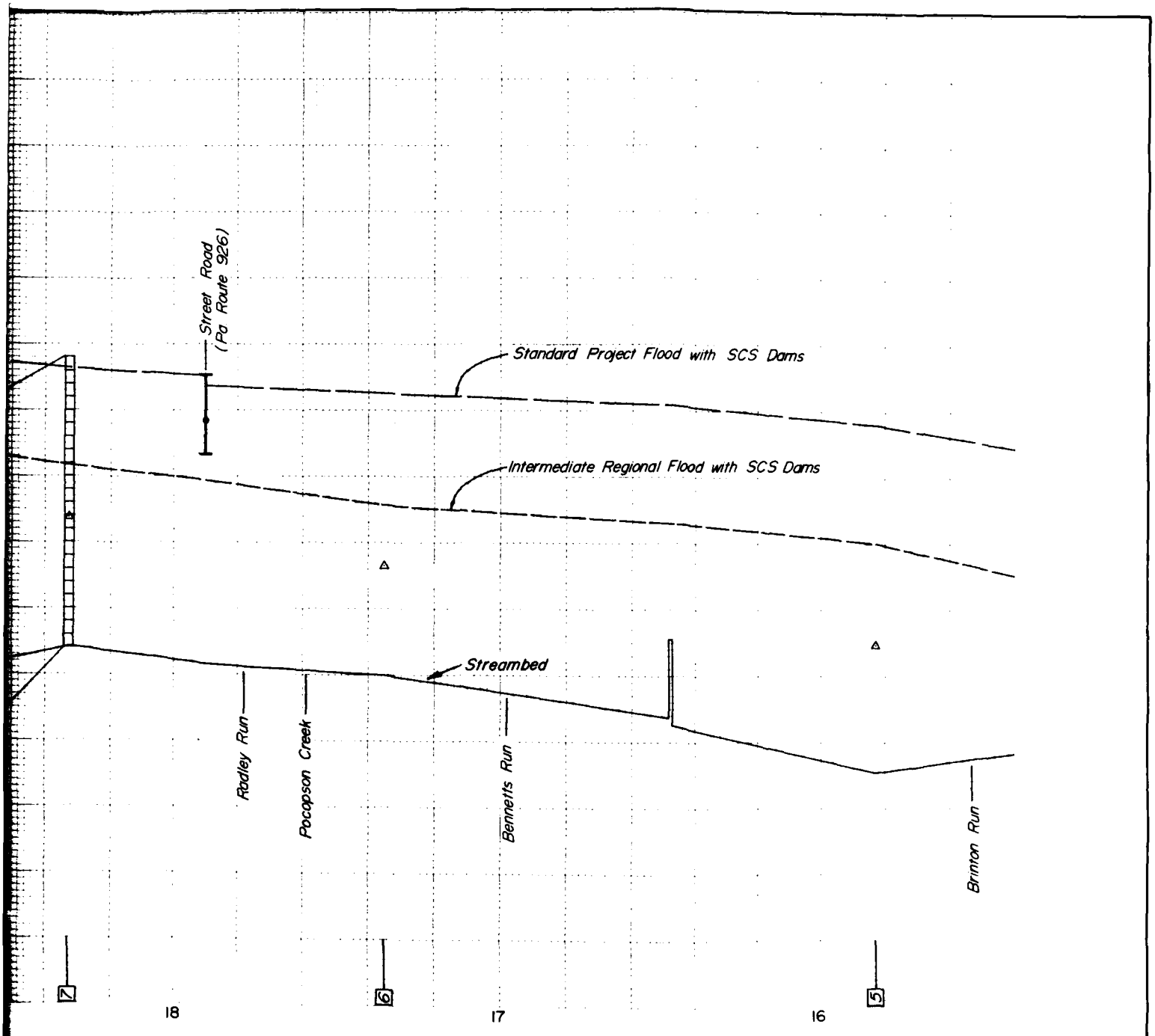
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA.

HIGH WATER PROFILE

MARCH 1972

PLATE 8


ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) MEAN SEA LEVEL DATUM
200
190
180
170
160
150
140
Study Limit
Lenape Road (Pa Route 52)
Street Road (Pa Route 926)
Confluence East and West Branch - Brandywine Creek
Plum Run
SPF
IRF
TOP OF LOW BANK
STREAMBED
20
19
18
MILES ABOVE
LEGEND
Top of Bridge Railing
Bridge Floor
Undercleorance
Top of Low Bank



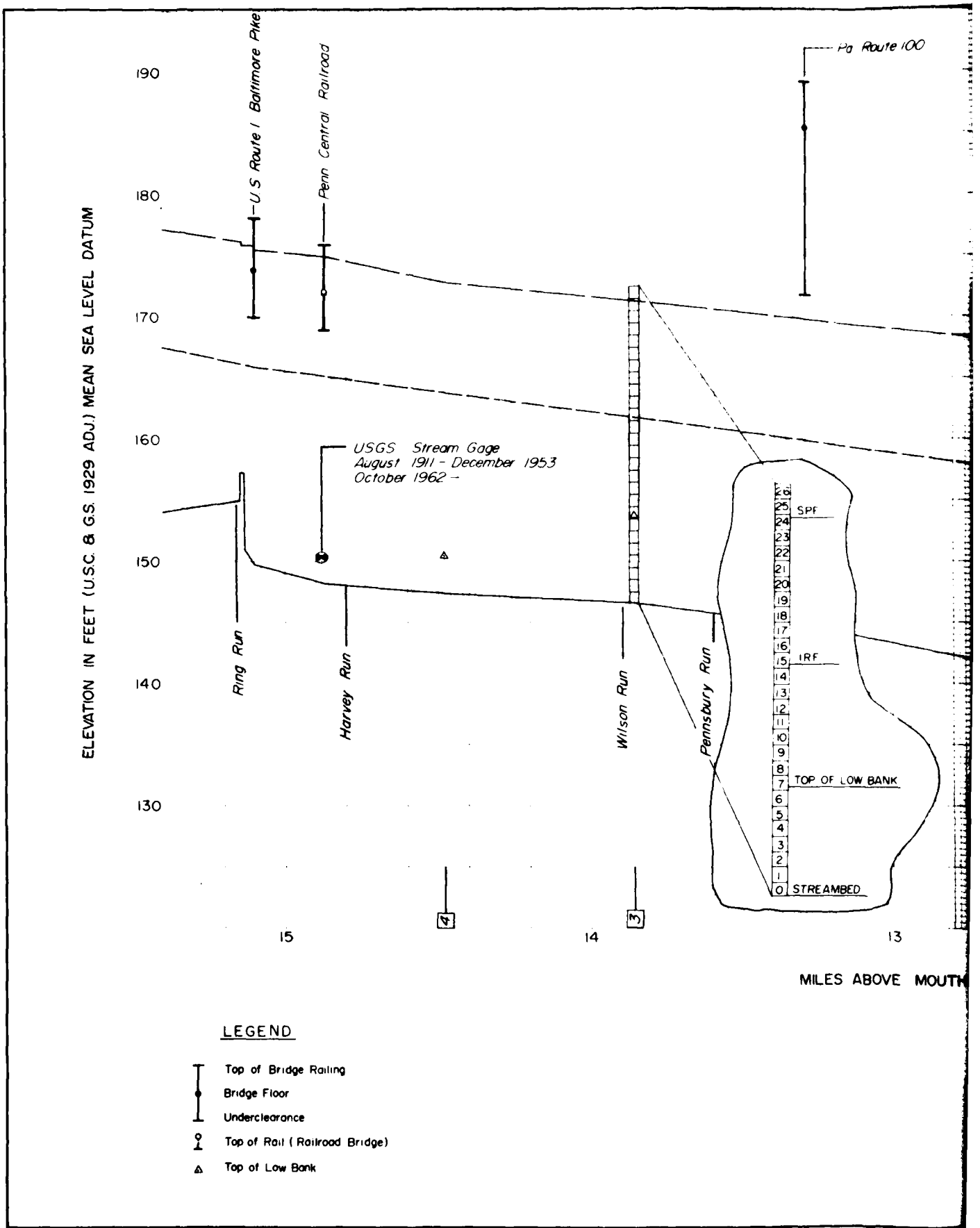
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

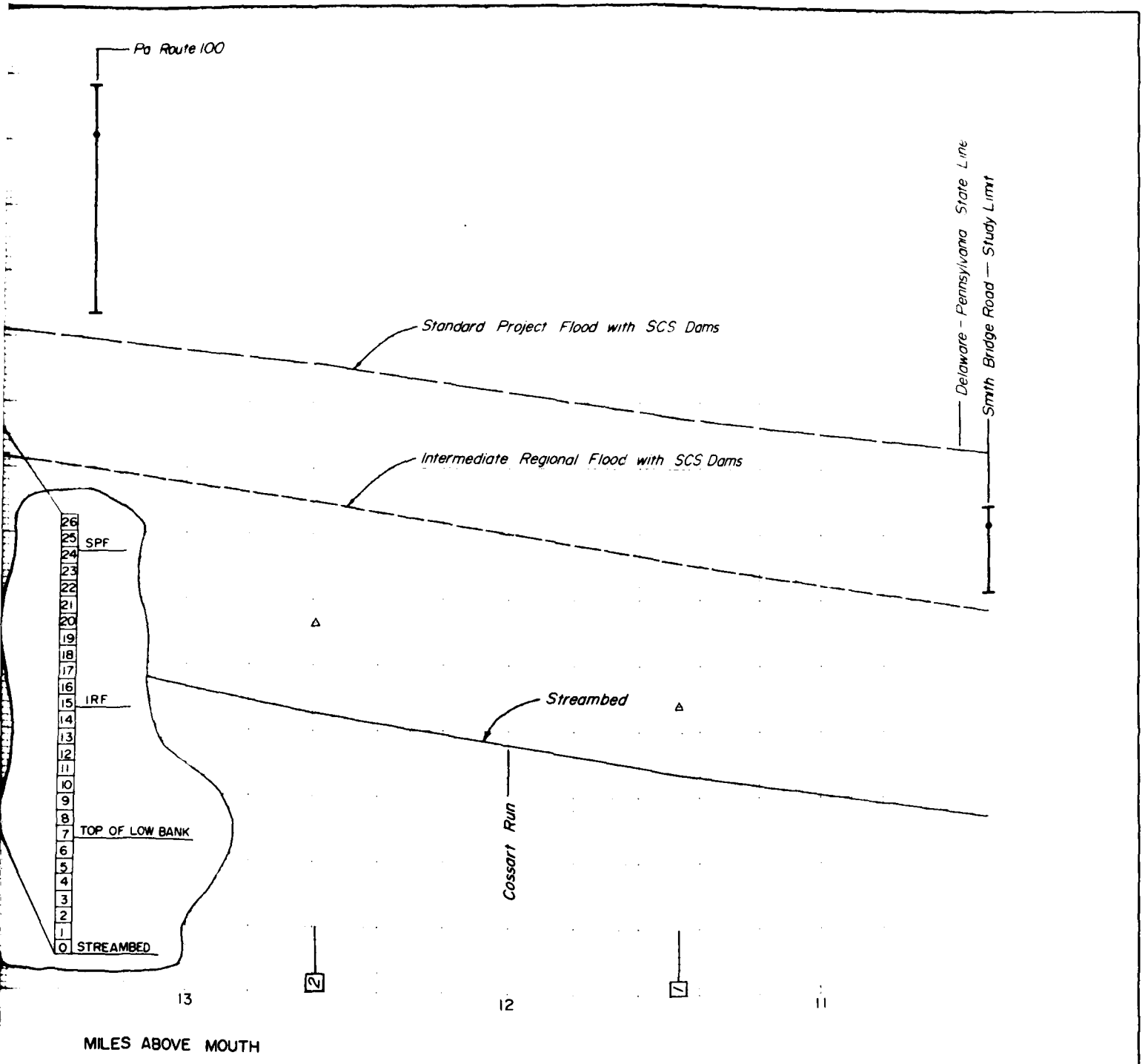
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA

HIGH WATER PROFILE
WITH SOIL CONSERVATION SERVICE DAMS

MARCH 1972

PLATE 9


ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) MEAN SEA LEVEL DATUM
190
180
170
160
150
140
130
U S Route 1 / Baltimore Pike
Penn Central Railroad
Pa Route 100
USGS Stream Gage
August 1911 - December 1953
October 1962 -
Ring Run
Harvey Run
Wilson Run
Pennsbury Run
SPF
IRF
TOP OF LOW BANK
STREAMBED
15
14
13
MILES ABOVE MOUTH
LEGEND
Top of Bridge Railing
Bridge Floor
Underclearance
Top of Rail (Railroad Bridge)
Top of Low Bank



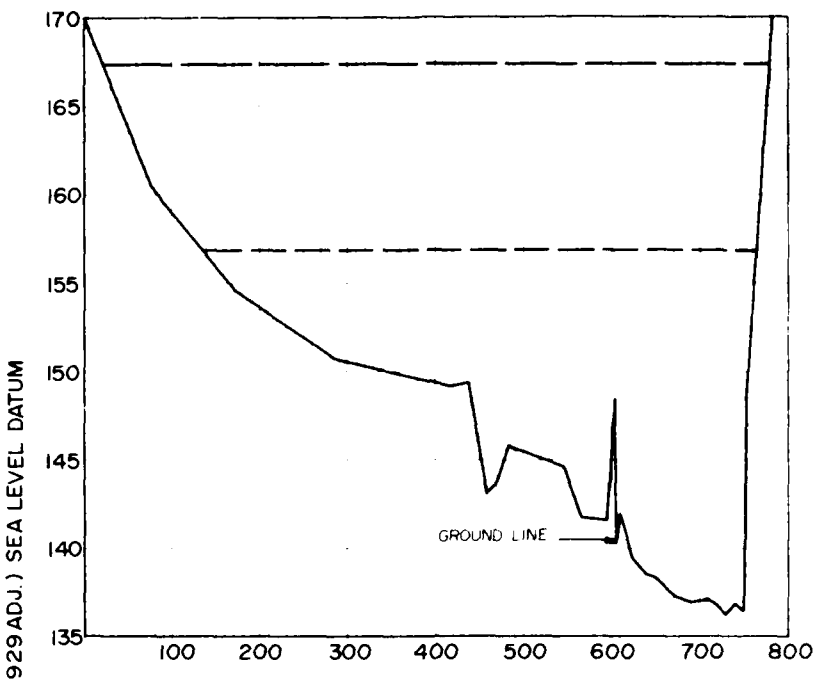
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA

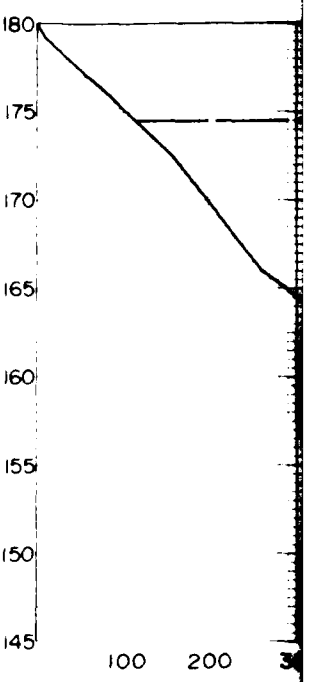
HIGH WATER PROFILE
WITH SOIL CONSERVATION SERVICE DAMS

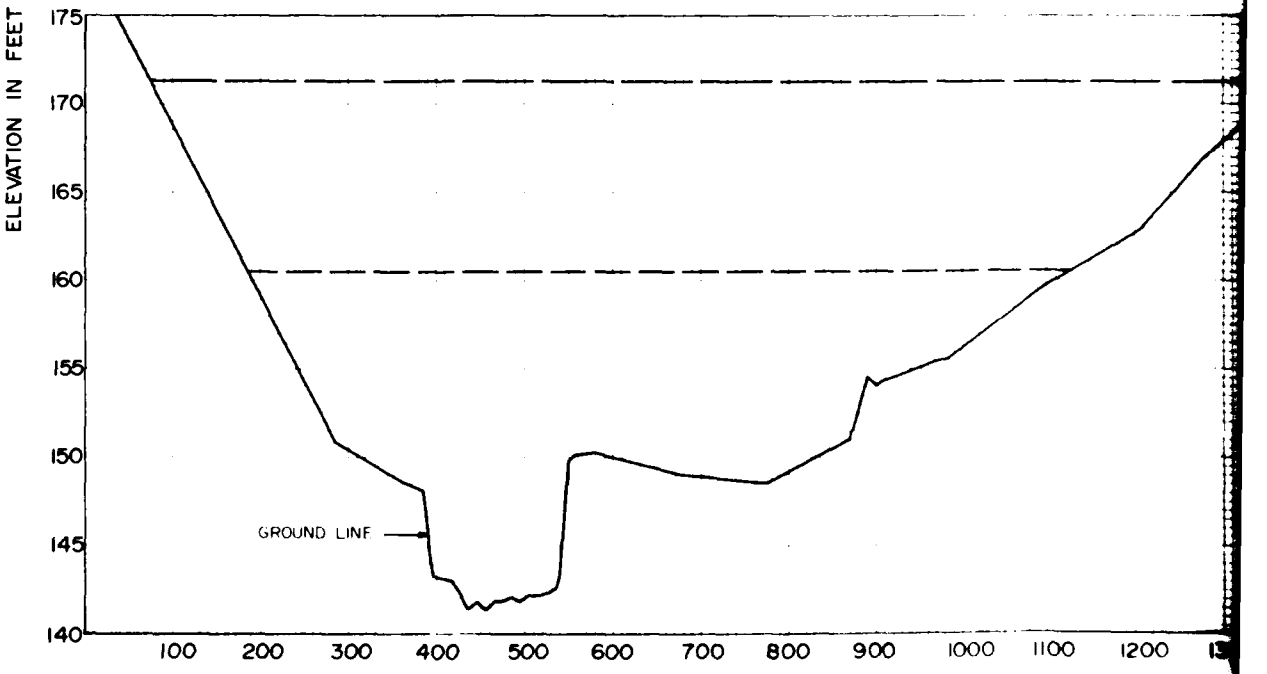
MARCH 1972

PLATE 10



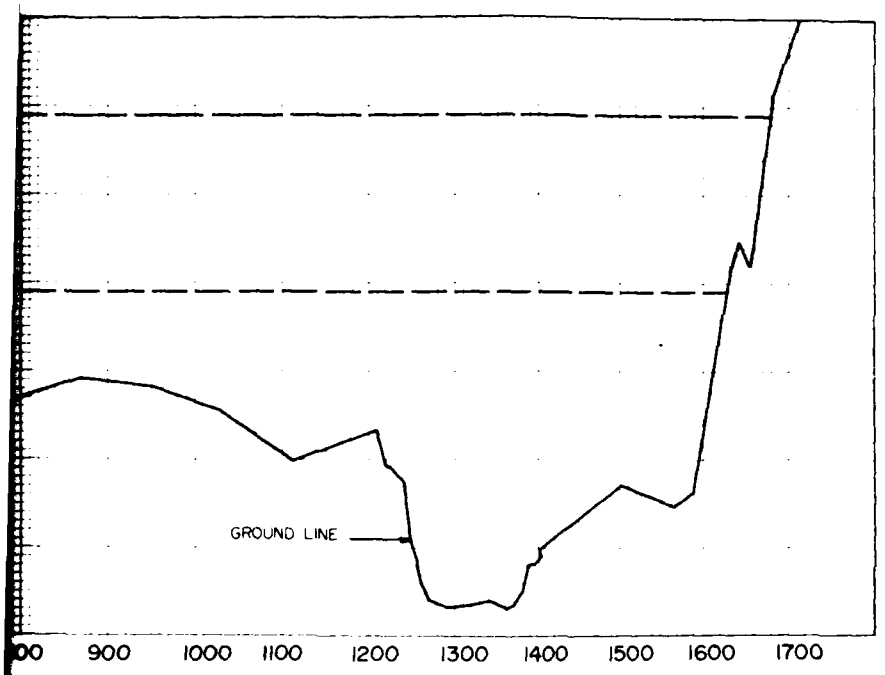
CROSS SECTION NO. 1
MILE 11.47



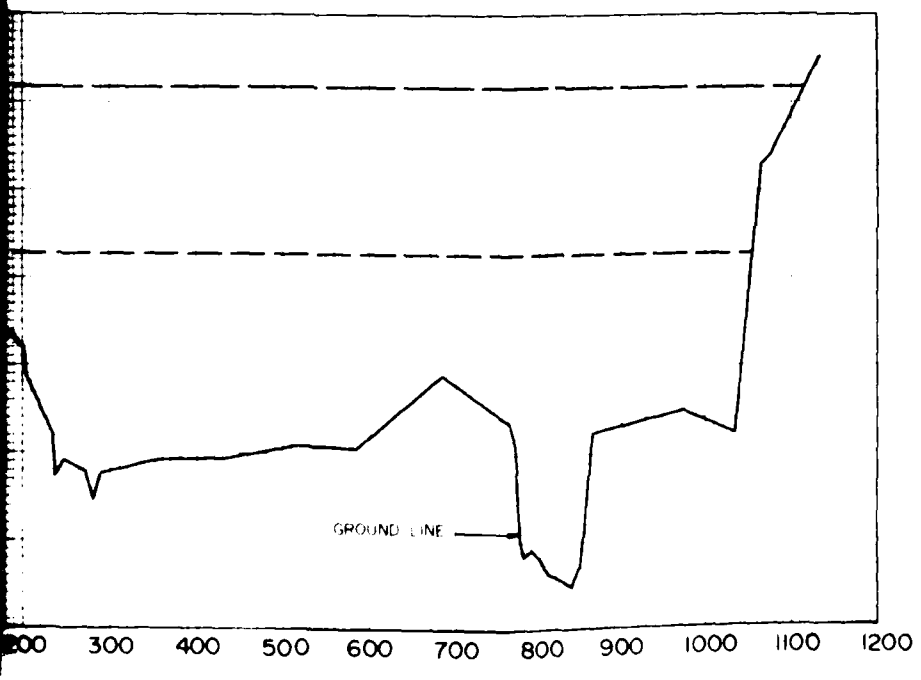


CROSS SECTION NO. 2
MILE 12.59

HORIZONTAL DISTANCE IN



S SECTION NO. 3
MILE 13.86



CROSS SECTION NO. 4
MILE 14.48

LEGEND

——— STANDARD PROJECT FLOOD
— — — INTERMEDIATE REGIONAL FLOOD

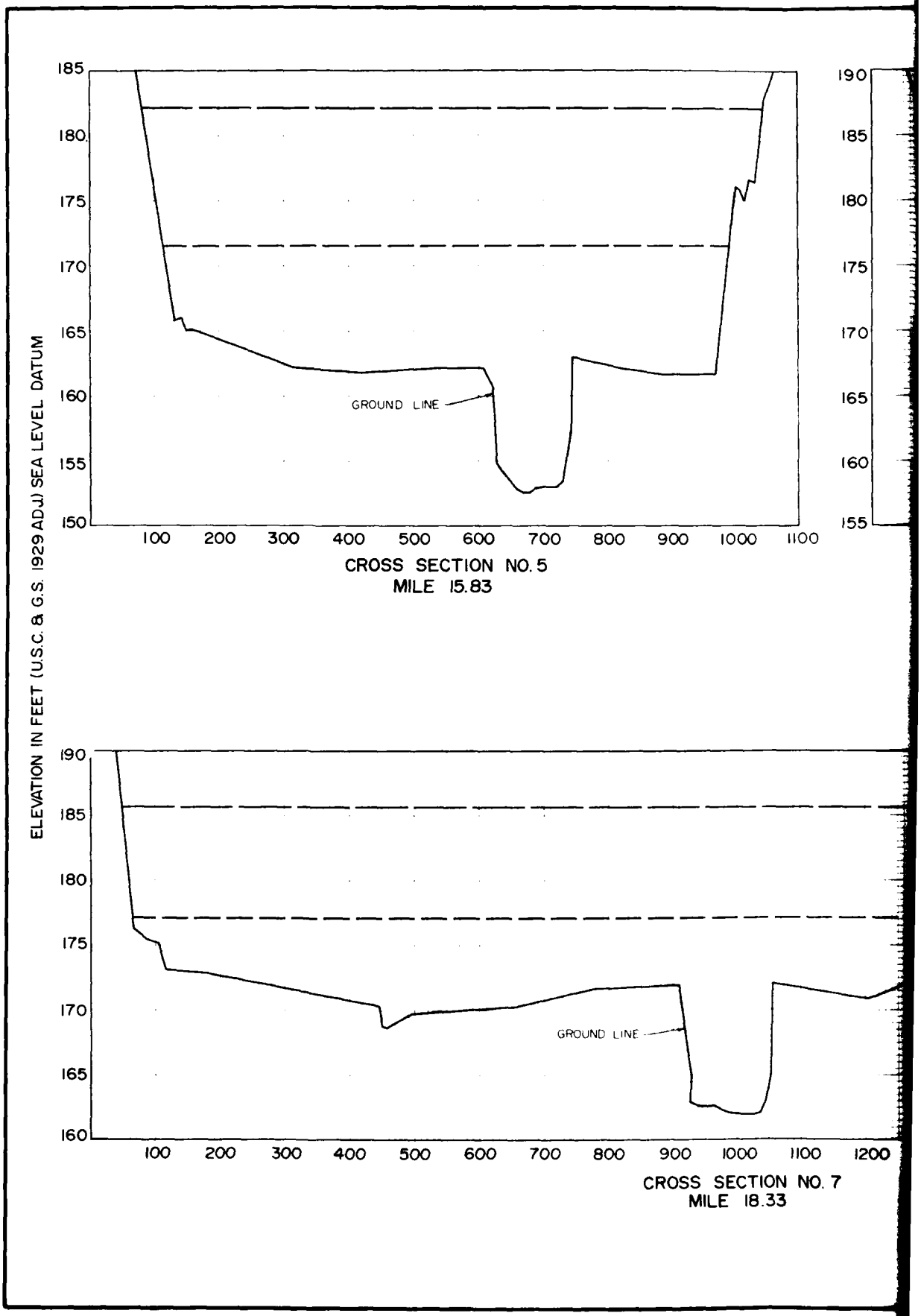
NOTE

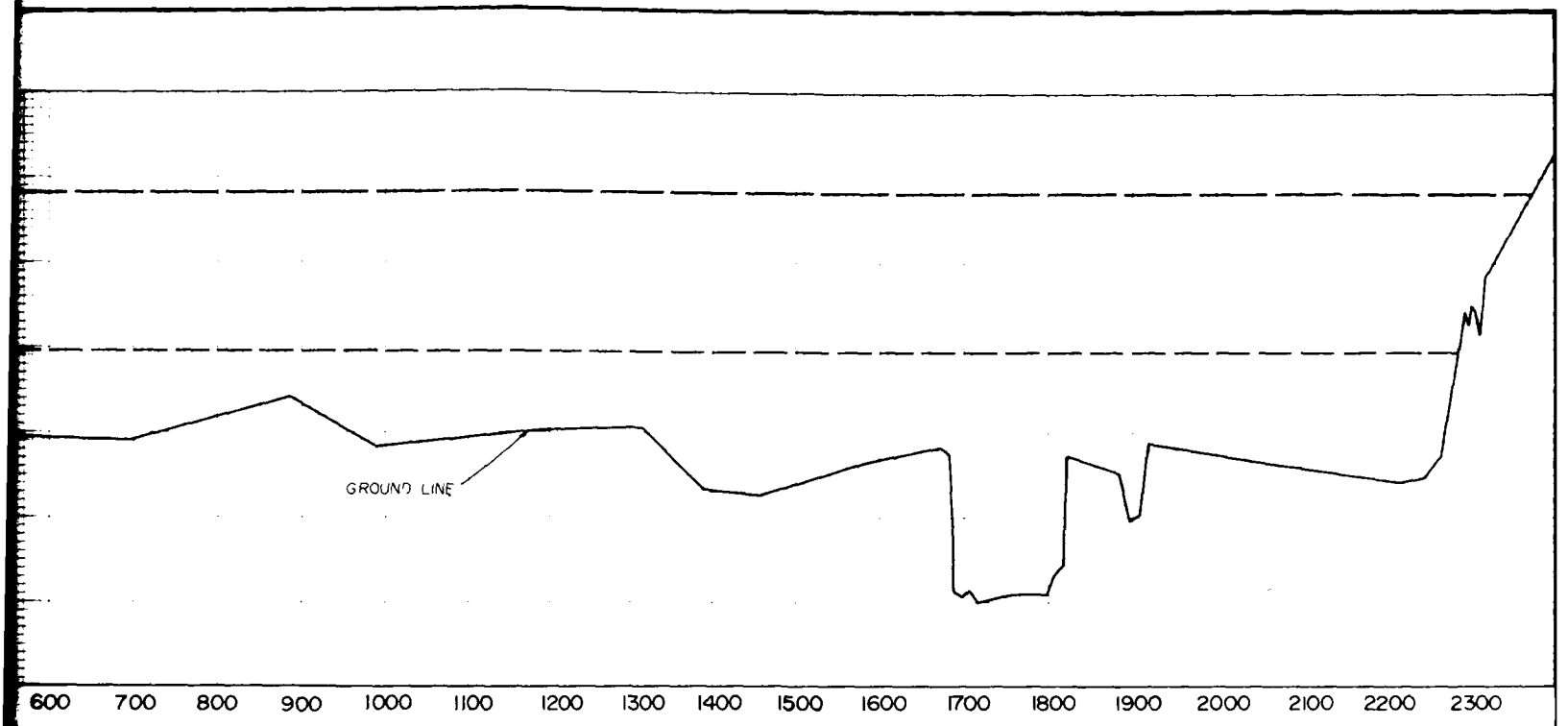
CROSS SECTIONS TAKEN
LOOKING DOWNSTREAM.

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA
FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA
CROSS SECTIONS

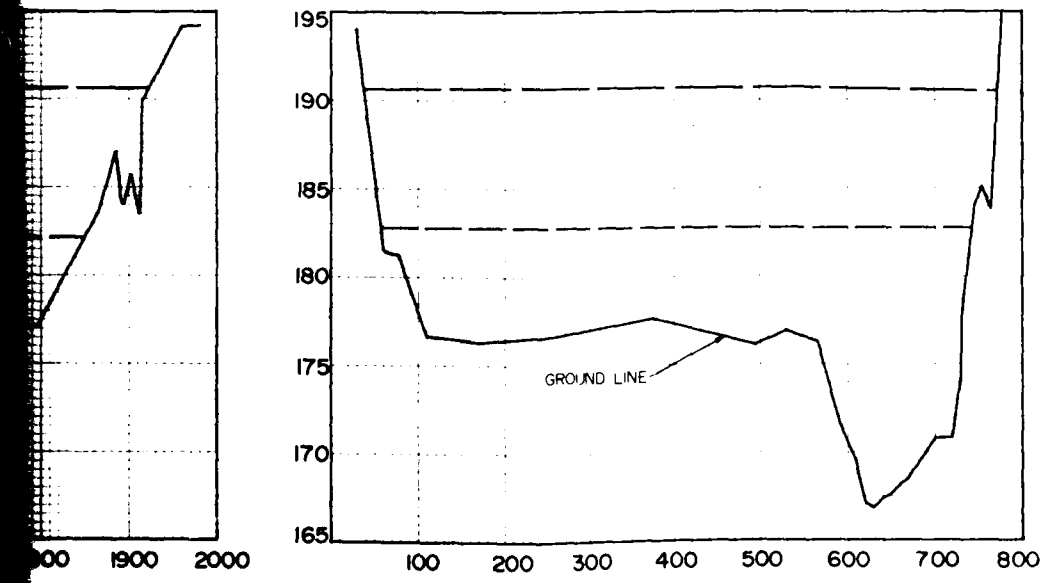
MARCH 1972

PLATE 11


ELEVATION IN FEET (U.S.C. & G.S. 1929 ADJ.) SEA LEVEL DATUM
185
180
175
170
165
160
155
150
GROUND LINE
100 200 300 400 500 600 700 800 900 1000 1100
CROSS SECTION NO. 5
MILE 15.83
190
185
180
175
170
165
160
GROUND LINE
100 200 300 400 500 600 700 800 900 1000 1100 1200
CROSS SECTION NO. 7
MILE 18.33



CROSS SECTION NO. 6
MILE 17.35



CROSS SECTION NO. 8
MILE 19.86

UNDREDS OF FEET

NOTE

FOR LEGEND AND NOTE SEE PLATE 11

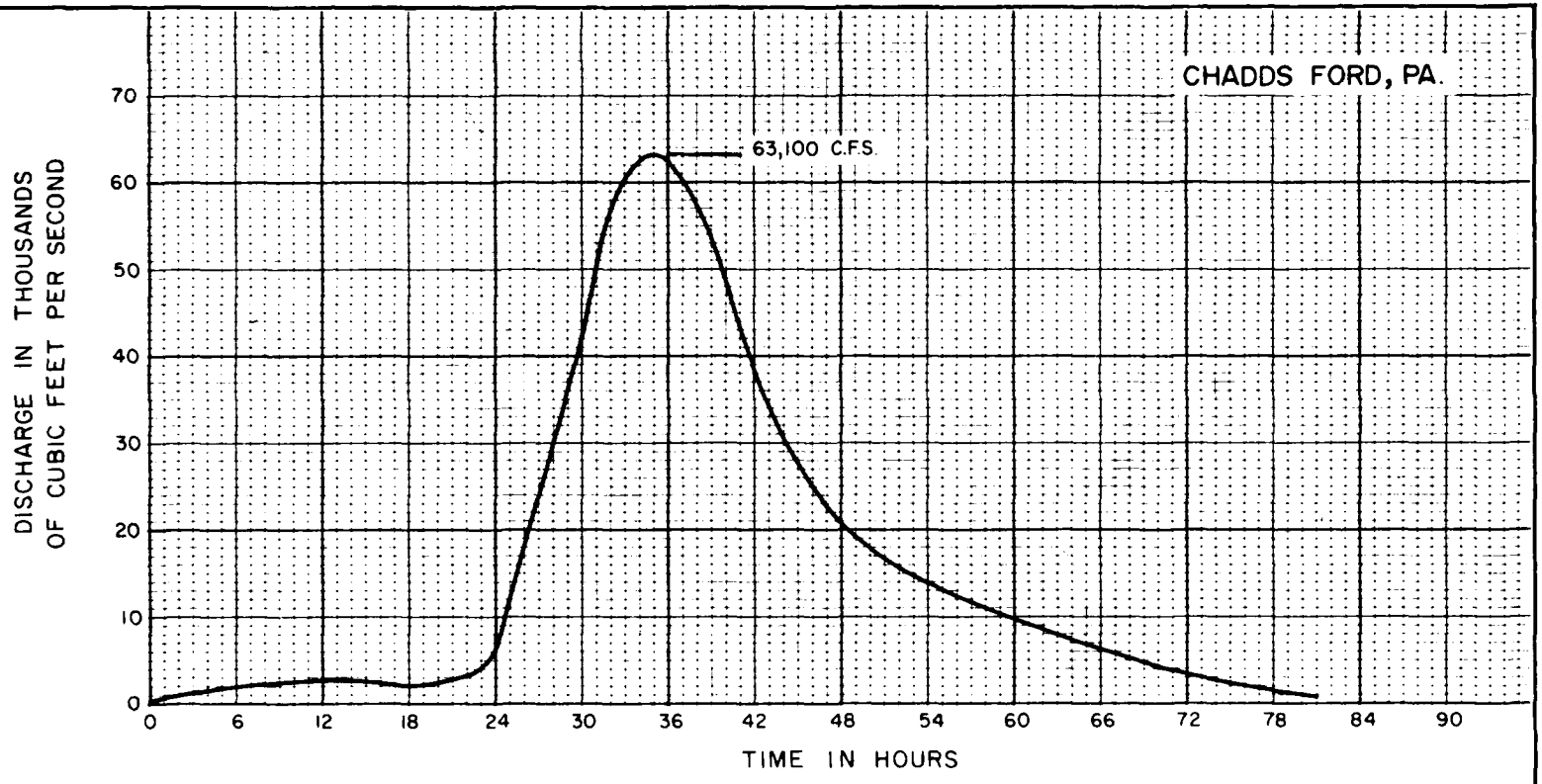
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

FLOOD PLAIN INFORMATION
BRANDYWINE CREEK
CHESTER COUNTY, PA

CROSS SECTIONS

MARCH 1972

PLATE 12



NOTES

USGS STREAM GAGING STATION
AT CHADDS FORD, PENNSYLVANIA

TOTAL DRAINAGE AREA = 287.0 SQ MILES

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT CORPS OF ENGINEERS
HILADELPHIA, PENNSYLVANIA

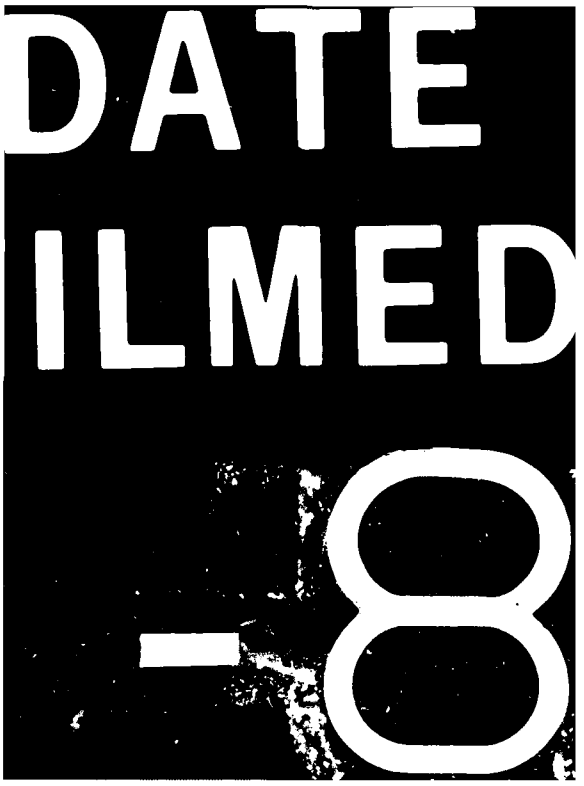
FLOOD PLAIN INFORMATION

BRANDYWINE CREEK
CHESTER COUNTY, PA.

STANDARD PROJECT FLOOD HYDROGRAPH

MARCH 1972

PLATE 13


DATE
ILMED
-8